A provisional inventory of ancient and long-established woodland in Ireland

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A provisional inventory of ancient and long-established woodland in Ireland

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EXECUTIVE SUMMARY

Ancient woodland refers to those woods that have had a continuous history of cover since before the period when planting and afforestation became common practice (mid-1600s). These woodlands are important in terms of their biological and cultural value, and may even form links with prehistoric wildwoods. To date, unlike our European counterparts, no extensive study of ancient woodland has been conducted in the Republic of Ireland, leaving these irreplaceable habitats open to threats such as woodland clearance. The overall objective of this study was to identify available resources, to develop a protocol for the identification of ancient woodland, and to initialise a *National Ancient and Long-established Woodland Inventory*.

Historical Ordnance Survey (OS) maps and a contemporary forest inventory were used to create a GIS database of areas that have been continuously covered by woodland since *c.* 1830. The 481 woodlands identified by this process were systematically researched using a set of historical national surveys. This allowed stands to be grouped into different woodland categories. Possible ancient woodland (PAW) stands have been continuously wooded since 1660. Long-established woodlands (LEW) have been continuously wooded since 1830 and there are two sub-categories, LEW (I) stands for which no evidence of antiquity could be found in older documentation, and LEW (II) stands for which there is evidence that the site is not ancient. Woodland that has originated since 1830 may be regarded as recent woodland (RW). Other maps and historical documents were then identified as potential resources for ascribing woodland antiquity and existing research on ancient woodland was collated. Supplementary research included toponymical research and a detailed examination of historical stand type.

Field visits were conducted on 23 PAW and 17 LEW (II) stands to collate floristic and environmental data. The woodland archaeology noted during the field surveys seems to indicate that Irish woodlands were managed in a similar fashion to British woodlands, with the majority of sites containing earthworks and coppice. The presence of large coppice stools and evidence of more extensive coppicing appear to be characteristics that may help to distinguish PAW sites from LEW (II) stands. Other means by which these sites may be identified include the presence of a woodland name and broadleaved symbols on the first edition OS maps. There was also a general trend showing that these woodlands commonly occur on parish boundaries.

A preliminary list of 29 ancient woodland vascular plant indicators for the Republic of Ireland was compiled. This list was compared with lists from Northern Ireland and Britain and the application of ancient woodland indicators in Ireland was reviewed.

Subsequent to this additional research, some PAW stands were upgraded to ancient woodland (AW) status**.** A final list of 123 sites at which PAW/AW stands occur was thus compiled through the combination of historical national surveys, maps and previous Irish ancient woodland research. A further list of 335 LEW (I) stands presented by this research represents a resource from which future ancient woodlands could be identified. A total of 81 LEW (II) stands were identified.

This inventory is provisional in nature, investigating only a subset of Ireland's woodland resource and available historical documents. However, it presents a working methodology to

assist in the identification of these sites in Ireland. This study also promotes taking a multidisciplinary approach in the study of ancient woodlands.

ACKNOWLEDGEMENTS

The provisional inventory of ancient and long-established woodlands in Ireland would not have not been possible without the hard work and assistance of a number of people and to these the authors extend their gratitude.

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We are further indebted to the many land owners who permitted us to survey their lands. This study has been funded by the National Parks and Wildlife service (Department of the Environment, Heritage and Local Government) and the Forest Service (Department of Agriculture, Fisheries and Food).

INTRODUCTION

Rationale

Ancient woodland is a term that refers to areas of the countryside that have had continuous woodland cover since before planting and afforestation became common practices. These sites are thus more likely to have natural origins and may form a link with the prehistoric wildwood that once covered much of Europe (Rackham 2003), although all are likely to have been managed at some time, and may bear little resemblance to the original forest cover. Ancient woodland sites often contain communities of animals and plants which are confined to, and dependent for their existence upon, ancient semi-natural woodland. Ancient woodland can also contain historical landscape and archaeological features which are important in their own right. The conservation importance of ancient woodlands has long been acknowledged in the rest of Europe, especially in Britain where the first detailed ancient woodland inventories were compiled in 1981. Ancient woodland inventories have played a key role in raising awareness of ancient woodlands and have become important tools for planners and policy makers (Pryor *et al.* 2002). They have also highlighted the alarming loss of this habitat in recent decades, through both clearances and conversions to non-native forestry (Spencer & Kirby 1992; Anon. 2007). Recently, a comprehensive project in Northern Ireland has identified ancient woodland sites there for the first time (Anon. 2007). However, hitherto the Republic of Ireland has lacked a national inventory of ancient woodland leaving these irreplaceable habitats vulnerable to threats. The recent completion of the *National Survey of Native Woodlands 2003-2008* (NSNW; Perrin *et al.* 2008), which involved the survey of over 1,200 native woodland sites in the Republic of Ireland provides an excellent resource to assist in the identification of these sites. It is vital that these habitats are identified so that the remnants of both our natural and cultural heritage can be conserved.

Previous research into ancient Irish woodland

Whilst there has not been a comprehensive study of ancient woodland in Ireland, it is not an issue that has remained entirely unaddressed. In his paper entitled '*Looking for ancient woodland in Ireland*' Rackham (1995) raised the question of whether any ancient woodland survived here and discussed the various types of evidence that a researcher might use: placenames, historical documents, pollen analysis, woodland structure, indicator plants, archaeology and earthworks. Rackham calculated that at the time of the Civil Survey (1654-1656) approximately 2.1% of Ireland was wooded but by the time of the first edition six inch to the mile Ordnance Survey (OS) maps (1830-1844) 90% of this woodland had been lost. He attributed this phenomenon to overpopulation in pre-famine Ireland, when all available land was grazed or cultivated. Hence by the 1830s only around 0.2% of the country was covered by pre-1660 woodland and much of this is likely to have been lost since to agricultural clearance and modern forestry. Rackham highlighted St. John's Wood and Rindoon Wood, Co. Roscommon, as well-preserved examples of ancient woods and called for the recognition and study of Ireland's remaining ancient woodlands before it was too late.

Other important studies include that of Kelly & Fuller (1988) and Fuller (1990) on three well-known woodland sites in the Irish midlands, Charleville, Co. Offaly, Abbeyleix, Co. Laois and St. John's Wood. They found good map evidence for the Park Hill area of Abbeyleix to be ancient woodland. Bohan (1997) took a multidisciplinary approach to research a selection of 70 sites from across Ireland and found evidence for 20 woods to be ancient or possibly ancient; these woods included six from the Killarney National Park.

As part of their commitment to Sustainable Forestry Management, Coillte Teoranta conducted a desk-based woodland history survey over the whole of their forest estate (Garrett 2001; O'Sullivan 2004). It was found that some 27,000 ha constituted 'old woodland sites', that is, sites that have been continuously wooded since the first edition OS maps of 1830-1844. Subsequent survey work has found that these 'old woodland sites' are of higher conservation value than plantations of recent origins, supporting a greater range of native woodland specialists (Daly 2008).

Other studies involving woodland history have typically been site-specific studies, such as those of Derryclare Wood, Co. Galway (Fahy *et al.* 1995) and Tomnafinnoge Wood, Co. Wicklow (Wilson 1995). Whilst not directly focussed on the issue of ancient woodland status, there have also been several palynological studies of woods that provide important evidence of continuous woodland cover, e.g. the Killarney woods (Mitchell 1988, 1990), Uragh Wood (Little *et al.* 1996), Slish Wood (Dodson & Bradshaw 1987) and Old Head Wood (Ní Ghráinne 1988).

The value of ancient woodland

All native woodland in Ireland is of conservation importance due to the small national resource estimated to cover only 1-2% of the country (Perrin *et al.* 2008). However, woodlands with a long history are of particular importance for a variety of reasons, not least that these potential links with the prehistoric wildwood are by their very nature irreplaceable. Veteran trees[1] provide valuable niches within the woodland environment (e.g. fissured bark and decay holes) and are particularly important for saproxylic species (Peterken 1999; Bee 2008). Ancient woodland also plays a role in preserving natural topographical features such as undisturbed relic soils (Ball & Stevens 1981) and unaltered watercourses, which are increasingly rare in the modern landscape (Goldberg *et al.* 2007). They are also of inherent cultural value and may contain a host of archaeological features (e.g. charcoal-hearths, limekilns, sawpits, wood-banks, quarries, coppice and pollards) which give clues into past land-use and traditional forms of woodland management (Byrne 2004).

In particular it has been widely recognised that woodlands with a long history of woodland cover exhibit a more diverse complement of plant and animal species than woodlands of recent origin, and hence are considered to be of higher conservation value. Species which are strongly associated with these woodlands are referred to as *ancient woodland indicators*. Ancient woodland indicators have been identified for a variety of taxa including vascular plants (Peterken 1974; Peterken & Game 1984; Brunet 1993; Wulf 1997; Rose 1999), bryophytes

[1] Veteran trees may not always be present in ancient woodland due to a history of coppicing or selective felling.

(Ratcliffe 1968; Hodgetts 1992), lichens (Rose 1976), fungi (Ing 1996) and invertebrates such as beetles (Garland 1983; Harding & Rose 1986; Speight 1989; Terrell-Neild 1990) and molluscs (Boycott 1934). Many of these species are considered rare or endangered; therefore the conservation of ancient woodlands will play an important role in maintaining these reservoirs that could eventually be used to restore other sites (Goldberg *et al.* 2007).

Vascular plants as ancient woodland indicators

As a group, vascular plants are relatively easy to identify by non-specialists and hence have been the taxa most widely studied in the UK and elsewhere in Europe as a means to assist in identifying ancient woodlands. Ancient woodland vascular plants (AWVPs) are those that display a marked association with ancient woodland when compared with recent, or indeed long-established, woodland. These plants usually have poor colonising abilities and are slow to invade new woodlands from old sites, a process made more difficult still by the high degree of isolation of ancient woodlands within the modern landscape (Rackham 2003). They are also often restricted to this habitat due to various environmental adaptations (e.g. to light, humidity or soil conditions), which results in competitive disadvantage when conditions change (Peterken & Game 1984; Wulf 1997; Pryor e*t al*. 2002). Good indicators should seldom occur outside woodland habitats.

The identification of AWVPs is complicated by the differing association of species with ancient woodland in different countries, and indeed between different regions in the same country (Kirby & Goldberg 2003). This may be due to regional variations in ecological conditions or due to geographical patterns of distribution. For example, *Lamiastrum galeobdolon* and *Mercurialis perennis* are indicative of ancient woodland in many parts of England, but would be of little use as indicators in Ireland where both are extremely rare and the latter is of dubious native status (Preston *et al*. 2002). Hence, regional or national lists of indicator species need to be developed. Lists of species associated with old / ancient woodland in Ireland were suggested as early as Henry (1914) and Praeger (1934). The *Back on the Map* project in Northern Ireland (Anon. 2007) has developed a list of plants including both vascular and bryophyte species that were found to be statistically significantly associated with ancient woodland. The applicability of this list to woodlands in the Republic of Ireland needs testing.

Definitions of ancient and long-established woodland

The following initial definitions for extant woodland stands are used in this project. They are based largely on those used in Northern Ireland (Anon. 2007). Note that no distinction is made here between the nature of the stands (semi-natural, mixed or conifer) at different points in history. In addition, coppicing or clearfelling is not regarded as a discontinuation of woodland cover.

Ancient Woodland is defined as areas of woodland believed to have remained continuously wooded since 1660[2]. This date is used as it was during the 1650s that the Down Survey and the Civil Survey were conducted to facilitate the confiscation of lands following the Cromwellian conquest and these are the two most useful historical resources available. Shortly after this time, planting of new woodland by English landowners would have been encouraged with the publication of Evelyn's Sylva (1664).

Possible Ancient Woodland is defined as areas of woodland that are thought to have remained continuously wooded since 1660, but for which evidence is not so strong, due typically to the somewhat ambiguous nature of names and locations in much of the 17th century literature.

Long-Established Woodland (I) is defined as woodland that has remained continuously wooded since the first edition OS maps of 1830-44, but for which no positive evidence of antiquity has been found in older documentation. These woodlands may however have ancient origins.

Long-Established Woodland (II) is defined as woodland that has remained continuously wooded since the first edition OS maps of 1830-44, but for which there is positive evidence in older documentation that it is *not* ancient in origin.

Recent Woodland is defined as woodlands that are not shown on the first edition OS maps of 1830-44 and hence are likely to have originated on unwooded terrain after this period.

Aims of the project

It was beyond the scope and resources of this project to conduct a comprehensive survey of ancient woodland in Ireland. Hence, the overall objective was instead to identify resources and develop a protocol for the identification of ancient woodland and to initialise a national inventory. This will provide a formal framework for future studies in ancient woodland. The aims of this project were therefore to:

1. Investigate the historical records available in the Republic of Ireland which can provide an assessment of woodland longevity.
2. Collate available information from previous research into ancient woodlands in Ireland.
3. Research through desk-based work and fieldwork a selection of woodland sites from across the country.
4. Produce a *National Ancient and Long-established Woodland Inventory* in the form of a GIS data layer showing the extent and distribution of researched sites.
5. Produce a preliminary list of ancient and long-established woodland vascular plant indicators for the Republic of Ireland and identify other pertinent features associated with these woodlands.

[2] This date differs from that of 1600 used in Northern Ireland (Anon. 2007) that was chosen for consistency with inventories of England and Wales. However, Goldberg *et al.* (2007) in reviewing the English inventories comments that in hindsight a later date may have been more appropriate as so much map evidence is much later. Scotland uses 1750 as this is the date of the set of military maps known as the "Roy" maps.

DESK-BASED RESEARCH

Overview

Historical Ordnance Survey (OS) maps and a contemporary forest inventory were used to create a GIS-based database of areas that have been continuously covered by woodland since *c.* 1830. Earlier maps and historical documents were then identified as potential resources for ascribing antiquity to woodland sites and existing research on ancient woodland was collated. Each site in the database was categorised using this information and a subset of sites was selected to examine cartographical characteristics.

Digitisation of ancient and long-established woodland

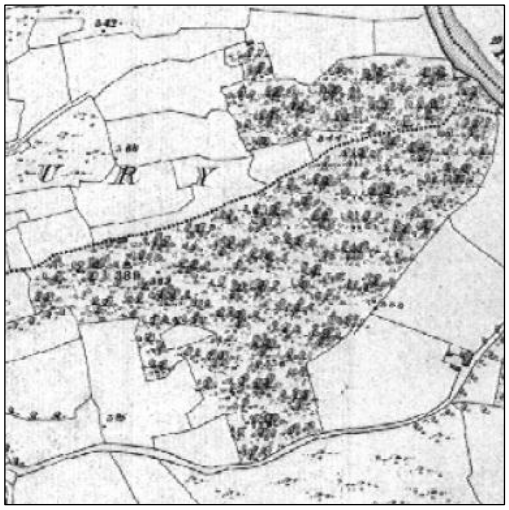
Site selection

It was beyond the scope of this project to research every woodland in the country. Therefore it was decided to build on the existing data from the NSNW. All sites in the NSNW database that were recorded as being present to some extent on the first edition OS map of 1830-1844 were identified. Following an assessment of the scale of the task only sites ≥ 5ha were selected for digitisation. This resulted in the selection of 481 sites. Until their antiquity has been researched, these sites will be referred to as ancient or long-established woodland (ALEW).

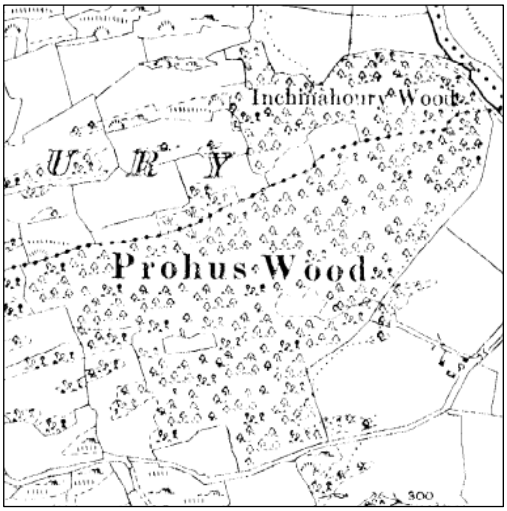
Digitisation procedure

Digitisation was conducted using the software package ArcMap 9.3 (ESRI, Redlands, California). Three GIS data layers were used in the digitisation process: first edition OS maps (1830-1844), third edition[3] OS maps and FIPS, the Forest Inventory Planning System 1998. FIPS is a GIS-based inventory of forest cover in Ireland developed by the Forest Service that was created through a combination of satellite imagery from 1993-1997 and ortho-rectified panchromatic aerial photographs taken in 1995. By overlaying the three GIS data layers, a common area of woodland at each ALEW site was established, which was then digitised at a scale of 1:5000 (Fig. 1). The newly generated polygons represent areas of woodland which are regarded as having been continuously wooded since *c.* 1830. Where the original NSNW site was part of a larger block of woodland or forestry, all areas in that block in common between the three GIS layers were digitised to place the site in a broader context. Aerial photographs taken in 2005 were used to confirm or alter existing woodland boundaries, thereby allowing recent modifications such as infrastructural developments or woodland clearance for agricultural purposes to be taken into account.

[3] The set of digital OS maps referred to here as the third edition is in fact an amalgam of sheets from the second and third editions and sheets from later revisions. No complete set of maps now exists for any edition except the first. Sheets within this amalgam could date from as early as 1848 to as late as 1957 depending upon the county. There are no metadata with the digital maps which are clipped of the margins in which the year of production would have been marked (R. Ovington, pers. comm.). It would therefore be necessary to access the original paper maps to obtain the date for each digital sheet.

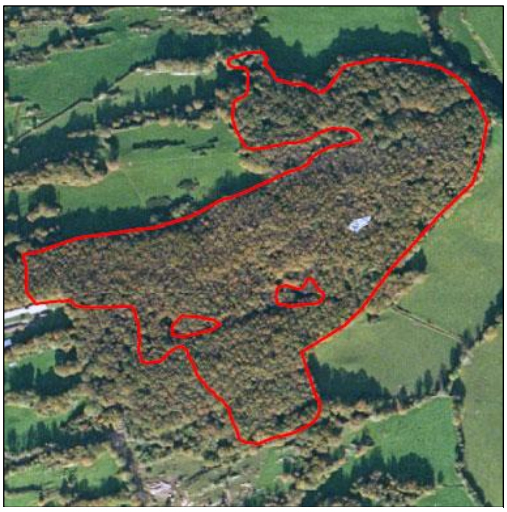


(a) First edition OS map (1830-1844)



(b) Third edition OS Map

(c) Aerial photograph (2005) and FIPS (1998), with purple colour depicting broadleaved woodland cover.



(d) Aerial photograph (2005) and ALEW boundary layer depicted in red, representing the common area of continuous woodland cover.

Figure 1: GIS Layers used in the digitisation of sites. Image depicts Prohus Wood, Co. Cork. [Ordnance Survey Ireland Licence No EN 0059208 © Ordnance Survey Ireland / Government of Ireland]

Data from FIPS were used to divide the areas of continuous cover woodland into polygons representing stands of different types. For the original NSNW sites, information from the NSNW field survey superseded the information supplied by the FIPS polygons. Aerial photographs were also utilised for visual interpretation of stand type where it was not clearly defined by FIPS or the NSNW survey. The different stand types comprised semi-natural broadleaf (SNB), mixed woodland (MW), conifer plantation (CP), non-native broadleaf (NNB) (e.g. stands dominated by *Fagus sylvatica, Rhododendron ponticum* or *Acer pseudoplatanus*) and recent clearfell (RC). Recent clearfell (RC) was used only for areas marked as clearfell in FIPS where it was not apparent what the developing stand type was from the aerial photographs. Where areas in a forestry context that were under canopy in FIPS appeared clearfelled on the

2005 aerial photographs, they were categorised according to FIPS, based on the assumption that they would be replanted with a similar species (as is often the case on Coillte estates) or regenerate into a similar stand type

Historical stand type

The first and third edition OS maps have specific symbols for broadleaf trees, conifers and brushwood. Mixed woodland is denoted by a mixture of broadleaf and conifer symbols. For each digitised polygon the stand type on the OS maps was determined. The categories used were broadleaf woodland (B), mixed woodland (M), conifer plantation (C) and brushwood (BW).

Polygons with two discrete stand types marked on the OS map were labelled after the dominant stand type, or if the proportions were essentially equal they were labelled mixed (M). Following Garratt (2001), where mixed woodland on the OS map contained less than 10% conifer symbols, the matching polygon was labelled broadleaf (B) rather than mixed (M). Where brushwood symbols were interspersed within areas of broadleaf and/or conifer symbols they were ignored. For small or narrow polygons that corresponded to areas on the OS map with a limited number of symbols for interpretation, stand type was based on that of the surrounding woodland.

Database

On completion of the mapping process, the attributes table for the digitised layer which constitutes the database for the inventory included the following fields, all of which were populated at this stage except for historical status. Full metadata details are given in Appendix 1.

- Name of site
- Name of townland
- Name of parish
- Ownership
- Name of county
- Area (m^2)
- Historical status
- Past stand type
- Current stand type

Digitisation coverage

Data on stand type frequency and area for the digitised polygons are given in Tables 1 and 2. Within the 481 ALEW sites digitised, a total of 2,739 polygons were defined covering an area of 16,674 ha distributed across the country (Fig. 2).

Table 1: Area and number of digitised ALEW polygons by current stand type

Stand type	**No. of polygons**	**Total area (ha)**
Semi-natural broadleaf	1,193	7,730
Mixed woodland	558	2,161
Conifer wood	620	4,764
Non-native broadleaf	134	523
Recent clearfell	192	1,161

Table 2: Area and number of digitised ALEW polygons by historic stand type

Stand type	No. of polygons		Total area (ha)	
	1st Edition	3rd Edition	1st Edition	3rd Edition
Broadleaf	1,100	1,002	7,258	6,297
Conifer	242	177	1,364	847
Mixed	1,293	1,392	7,486	8,594
Brushwood	63	127	232	602

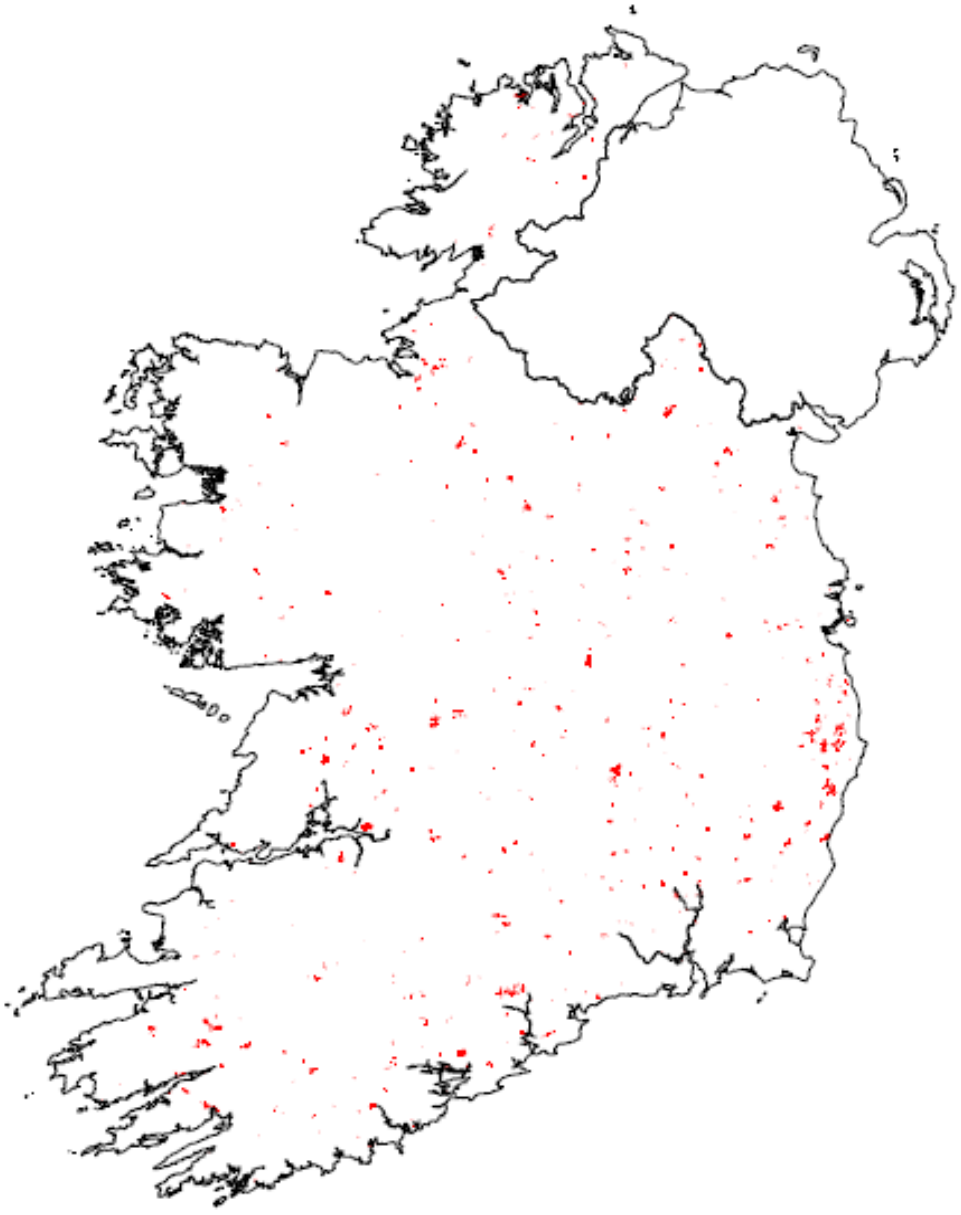


Figure 2: Map showing the distribution of digitised ALEW sites. Areas are slightly exaggerated for visual purposes.

Historic maps and documentary sources

Historical national surveys

Four historic documents were identified that constituted the main sources used to assign woodland antiquity status. These documents were examined systematically for all digitised ALEW areas. On account of two major fires in the Surveyor-General's Office in 1711 and the Public Records Office during the Irish Civil War in 1922, coverage of the whole country by the following sources is incomplete.

The Civil Survey of Ireland (1654-1656)

This survey was established to profile the Irish lands that were due to be confiscated and redistributed to the English under the Act of Settlement, 1652. The Civil Survey was dependent upon the Irish citizens to testify to their possessions under oath before the Courts of Survey. The original survey covered 27 counties. The surviving documents cover Cos. Donegal, Dublin (all baronies except Newcastle and Upper Cross), Kerry (only Clanmaurice barony), Kildare (except Ophaley barony), Limerick, Meath, Tipperary, Wexford (except Forth barony), Waterford and Cork (only the Muskerry barony, and North and South Liberties). The territorial basis of the survey was the barony, whose boundaries are described in great detail in the published volumes. Brief descriptions of both parishes and townlands are also given, highlighting the estimated acreage of profitable and unprofitable lands. Woods are referred to in a variety of ways in the text including *timber wood, copps, underwood, pasturable woods, rocky woods, shrubby woods, scrub* and *dwarf wood.* The Civil Survey has been transcribed and published as a series of typeset books.

The Down Survey (1655-1657)

The Down Survey comprises a series of barony and parish maps of the confiscated Irish lands and was completed under the direction of Sir William Petty. It was carried out by trained surveyors and military engineers, who traversed townlands and surveyed all boundaries. The maps were plotted at scales of either 40 or 80 Irish (or 'plantation') perches[4] to an inch (Andrews 1997) and are described as the most accurate maps of the 17th century. The maps depict several topographical features including woodlands and bogs. On the barony maps, woodlands are only occasionally depicted (Fig. 3) but they are often portrayed on the parish maps (Fig. 4). The maps are accompanied by a series of 'terriers', books that provide descriptions of both barony and parish boundaries along with the land quality of each townland. The Down Survey maps are available on microfilm in the National Library of Ireland (NLI) covering counties Carlow, Cork, Dublin, Kilkenny, Laois, Leitrim, Limerick, Longford, Offaly, Tipperary, Waterford, Westmeath, Wexford, Wicklow and the eastern half of Meath.

The Strafford Survey of Connaught (1636-1640)

This survey is the earliest known plantation survey. The original survey does not survive, but it served as part of the basis for the Books of Survey and Distribution. However, a Sligo transcript, which is believed to be a preliminary survey still exists and was examined for the purposes of

[4] Irish or plantation perch = 7 yards

this study. It details townland ownership and the number of cattle each townland can graze. The presence of woodland is alluded to in a covert manner as either firewood or shelter for livestock (Nicholls 2001). This transcript is held by the Manuscript Department of the NLI. Some surviving maps for Roscommon and Clare[5] also exist.

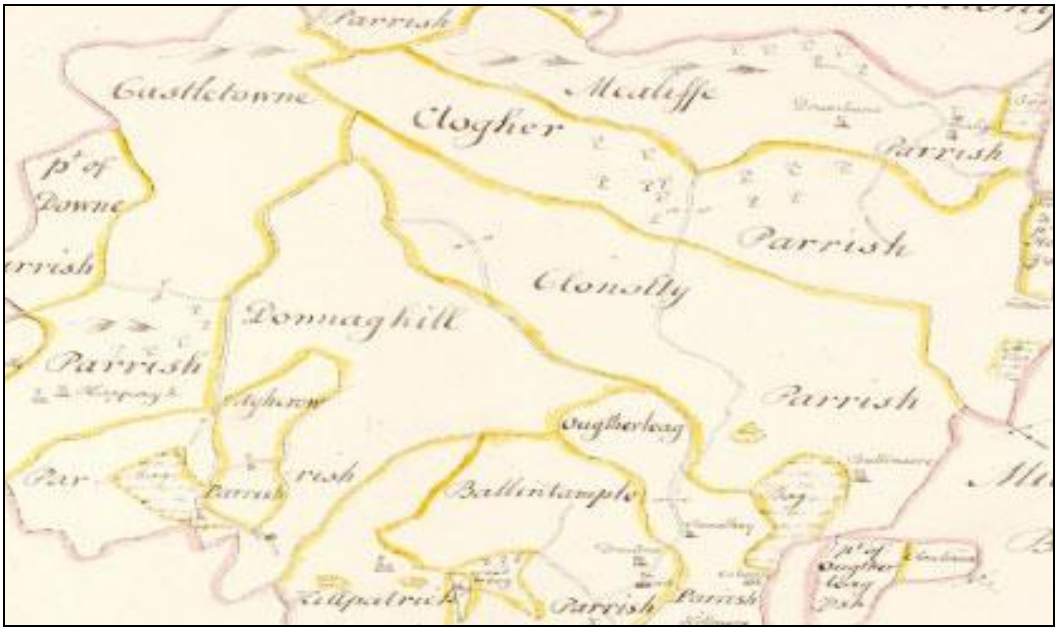


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Figure 3: Detail of Down Survey barony map of Kilnamanagh Lower, Co Tipperary. Note woodland marked in centre of 'Clogher Parrish' and southern end of 'Castletowne Parrish'.

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Figure 4: Detail of Down Survey parish map of Clogher in the Barony of Kilnamanagh Lower, Co. Tipperary. Note the townlands containing woodland are labelled with the acreage of *Timber Wood*.

[5] Several early maps and surveys place Clare in Connaught rather than Munster.

The Books of Survey and Distribution (1680s)

The Books of Survey and Distribution record land ownership in Cromwellian Ireland. They reference the Civil Survey, Down Survey and Strafford Survey of Connaught. Copies of the original Books of Survey and Distribution are available for all counties with the exception of Dublin, Louth and Meath. The Manuscript Commission has also published four of the Books of Survey and Distribution, those for counties Clare (copies of original document), Mayo, Galway and Roscommon (typeset). These four counties are the only ones that provide valuable descriptions of the type of lands contained within each townland. The most descriptive volume with regards to woodland is that for Co. Roscommon which often indicates the structure and even composition of its woodlands (e.g. *thick woods*, *hazel woods*, *tall thick woody pasture* and *rocky pasturable wood*). The descriptiveness of the other published volumes varies, with no townland descriptions given for half the baronies in Galway and three baronies in Clare (Nicholls 2001).

Miscellaneous maps and historical accounts (16th – 18th century)

Historical maps held by the NLI, Trinity College Map Library and Trinity College Manuscript Library that may be useful in the study of ancient woodlands were also identified, although it was not possible to systematically examine all these resources in detail for this survey.

General maps of Ireland

General maps of Ireland became more numerous in the 17th century. Caution should be exercised when examining these maps as relaying precise topographical information was often not their primary objective (Andrews 1997). There is also the risk that early cartographers lacking topographic information may have filled in blank spaces with tree symbols (Bohan 1997). General maps of Ireland that depict woodland include those by Boazio, *c.* 1599, and Speed, 1610. Boazio's map (TCD MS 1209/83)[6] depicts a lavishly wooded landscape, which is likely to have been an exaggeration (Andrews 1997). Other cartographers such as Speed had never visited Ireland, with their work based piecemeal on earlier cartography and second hand information. In addition, on small scale maps tree symbols are likely to be restricted to areas renowned for vast tracks of woodland (Bohan 1997). Sir William Petty's single sheeted map entitled 'A General Mapp of Ireland' which was printed in his *Hibernia Delineatio* (1685) contains only minor detail according to Andrews (1997). Forbes (1932) considered Moll's Map of Ireland, 1714, the most useful for indicating the presence of woodland; however, at the time of writing this map was missing from the NLI archives.

Provincial Maps

Provincial maps of Ireland include those by Sir William Petty, Robert Lythes, Richard Bartlett and Francis Jobson. Jobson's Map of Munster (NLI MS. 16.B. 13)[7] clearly portrays the distribution of woodland in the fortified lands of Cos. Cork, Kerry, Limerick and Waterford in 1592 and depicts the modern day woods of Uragh, Tomies and Carrigawaddra Wood, Co. Kerry and Glengarriff, Co. Cork (Bohan 1997). Another important provincial map regarded as

[6] Trinity College Dublin manuscript number.

[7] National Library of Ireland manuscript number

accurate in its depiction of woodland is John Brown's map of the province of Connaught, 1584 (Fig. 5; TCD MS 1209/68).

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Figure 5: John Brown's map of Connaught, 1584.

John Brown's map of Connaught and his associated map of Co. Mayo, 1584, (PRO MPF 92)[8] were used to investigate the digitised ALEW sites in more detail. Out of the 102 woodlands located in the old Connaught, 11 appeared to be depicted on John Brown's maps comprising five woodlands in Co. Galway, three in Co. Mayo, two in Co. Roscommon and one in Co. Sligo (Table 3). Brown's maps depict barony boundaries along with relatively accurate topographical detail, hence placement of woodlands was relatively straightforward.

Table 3: ALEW woodlands depicted on John Brown's maps of Connaught and Mayo, 1584

NSNW No.	Woodland	Description
1624	Annaghwood (Co. Galway)	Woodland shown to the southwest of Lough Corrib (although not directly along the lough's shore)
1602	Ballynahinch (Co. Galway)	Woodland depicted in the Ballynahinch Barony in the general position of this woodland (close to the Moycullen Barony).
1601	Derryclare (Co. Galway)	Woodland depicted in the Ballynahinch Barony in the general position of this woodland (close to the Moycullen Barony).
1599	Gortnahoon (Co. Galway)	An expanse of woodland depicted to the southwest of Lough Corrib (unclear if it definitely extends to the Gortnahoon townland)
1630	Kilbeg Lower (Co. Galway)	Woodland depicted at the southern end of Lough Mask
1777	Brackloon Woods (Co. Mayo)	Woodland depicted west of the Owenween river in the Brackloon area.
1763	Pontoon Woods (Co. Mayo)	Woodlands shown in the Knockaglana area, to the west of Lough Cullin.
1769	Raheens (Co. Mayo)	Expanse of woodland shown across the river from the Castlebar area.
1404	Clogher (Co Sligo)	Woodland shown to the west and northwest of Lough Gara in the 'half barony of Coolavin'.
485	Knockranny (Co. Roscommon)	Large expanse of woodland shown above Lough Key, this area of woodland extends to the northern tip of the county.
1231	Thomastown Demense (Co. Roscommon)	Large part of south Roscommon depicted as being wooded along the eastern edge. *Note:* The woodland does not extend as far as St. John's Wood (NSNW No. 467), which is depicted as treeless.

County and barony Maps

One of the more well-known county maps is the Elizabethan Map of Laois and Offaly from 1563-65 (Fig. 6; TCD MS 1209/9). It depicts great topographical detail including woodland, settlements, rivers, bogs, and even esker ridges. The prominence of woodlands in the region, albeit a slight exaggeration according to Andrews (1997), has been used to indicate the antiquity of the Charleville and Abbeyleix estate woodlands (Fuller 1990). Other county maps include those by Petty, which were published in his 1685 work *Hibernia Delineatio,* and reconstructed from the larger scale parish and barony maps of the Down Survey. Bodley's maps of Ulster, 1609, are a series of maps at the barony level that include counties Cavan and Donegal. They show features such as rivers, bogs, tree symbols, hills and churches within townland

[8] Public Records Office manuscript number

boundaries (Fig. 7). Although there are several inaccuracies, as they were based on verbal information from locals rather than precise mapping, they can provide a useful guide, with Co. Cavan regarded as one of the best surveyed counties (Smyth 2006). At the time of writing, the map of Co. Donegal is missing.

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Figure 6: Elizabethan map of Laois and Offaly 1563-65. Note the vast swathes of woodland depicted and that north is to the right of the map.

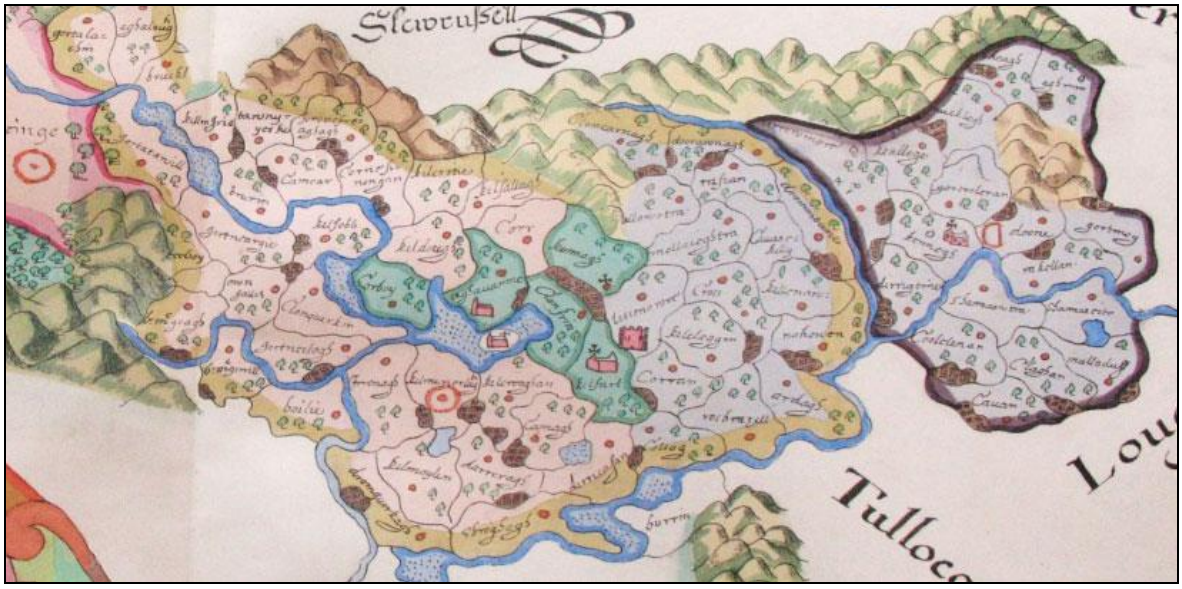

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Figure 7: Detail of Bodley's map, 1609, showing eastern part of the barony of Tullyhaw, Co. Cavan. Note the occurrence of tree symbols in many of the townlands.

Jacob Nevill's map of Co. Wicklow, 1760, is rather late for defining woodland antiquity as defined by this study, but it is regarded as one of the most detailed maps from this period and can date some woods back 70 years earlier than the first edition OS maps (Fig. 8). This map was also examined in detail to try to identify depictions of ALEW sites. Of the 34 woodlands located in Co. Wicklow, 12 were clearly depicted on Nevill's map (Table 4). The topographical detail on the map includes rivers, road systems and settlements, along with the annotation of many of the townland names, thus facilitating easy location of the woodlands. It is likely that the contour lines in Nevill's map were given preference over tree symbols in many cases. This phenomenon was also noted in the study of British cartography by Spencer and Kirby (1992).

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Figure 8: Nevill's map of Co. Wicklow, 1760, depicting the woodlands of Powerscourt (left) and Tomnafinnoge or Coolattin (right).

Estate Maps

The majority of the NLI manuscript library archives are composed of estate records. Although earlier records do exist, the greater part of these documents date from the 19th century. Researching estate records is a time-consuming process with a poor success rate due to the fact that not all estates were mapped, some records are still in private ownership and records if present are often incomplete (Anon. 2007). Estate records are worth researching for individual woods or localised studies, but it was not possible to consider them any further for this project.

Miscellaneous historical accounts

These may include written surveys, diaries and travelogues. Some of these miscellaneous sources have often been explored in the works of woodland historians including McCracken (1971), Forbes (1932), Hore (1856-7; 1858), Le Fanu (1893) and Nicholls (2001). Hore (1856-7; 1858) focused on Sir George Carew's manuscripts, 1603-24, which listed '*the woods and fastnesses'* in Munster, Connaught and Leinster. These documents give an account of the great woods of these regions, mentioning extant stands including the woods of Glengarriff, Co. Cork,

Glenflesk, Co. Kerry, Shillelagh, Co. Wicklow and Killoughrum, Co Wexford (Bohan 1997). The Munster plantation surveys, 1584, are another valuable source for assigning antiquity. Although many of the documents have been lost, the Kerry transcript survives in full and is thought to mention the extant stands of Glannageenty, Tomies, Ross Island, Reenadinna and Camillan (Nicholls 2001; Bohan 1997). 'A tour in Ireland' by Arthur Young is an example of a travelogue from 1776-1779. Neeson (1991) presents the following description of Young's for the now non-wooded landscape in Clonegar, on the southern banks of the River Suir: '*the whole wood rises boldly from the bottom, trees upon trees to a vast height, of large oak*.' Were this oak wood still standing this description would have granted it ancient woodland status as it was apparently much greater than 120 years old in 1780.

Table 4: ALEW woodlands depicted on Jacob Nevill's map of Co. Wicklow, 1760.

NSNW No.	Woodland	Description
746	Baltynanima	Large trees symbol depicted in the Baltynanima townland. Only contours shown in Carrigroe and Drummin (Dronieen).
785	Castlekevin	Woodland is shown along the river (east of Ballard Hill) and to the south of the small tributary.
814	Cronroe	Woodland shown behind Cronroe House.
783	Deputy's Pass	Woodland shown in Ballygannon, Ballyfree and Ballykillavane. No woodland depicted in Kilnamanagh, Ballinacooley and Lower Ballymanus.
775	Derrybawn	Only contours depicted for the majority of the site. However, large tree symbols are shown towards the river on the Ballard Hill side.
922	Dunganstown West	Two tree symbols shown west of the Church.
951	Kilcarra West	Woodland depicted along the river in Kilcarra. In Rostygah, woodland is depicted on the steep west-facing slopes towards the river. Woodland shown in Pollahoney, Glenart, Ballyraine and the northern section of Ballyduff woodland.
789	Knocksink	Only contours depicted each side of river; however, tree symbols shown on the lower slopes and flatter ground.
800	Powerscourt Demense South	Tree symbols shown in the location of the main body of the wood, especially on the north side of the river. Only contours depicted each side of the river between the townlands of Ballinagee and Bahana. A few tree symbols are depicted on the flatter ground above this area.
1190 / 779	Shelton/Shelton North	Woodland shown all along river and up the western slope of the valley. Woodland also located on the extreme south-eastern slope and on the flatter ground. Only the contours depicted in Ballanagh and Ballyarthur. No woodland shown in Sheepwalk and Killeagh.
749	Tomnafinnoge	Woodland depicted in Tomnafinnoge, Ballykelly and the northern section of Coolattin.
338	Vale of Clara	Woodlands present in Cronybyrne, Clarabeg, Ballyfree, Ballydowling and Ballyknockan. A few shrub symbols shown near the river in Copse. Only contours depicted in Ballymacsimon, Ballylusk, Barnbawn and Ballymanus. Ballinderry, Stump of the Castle and Rathdrum have no tree symbols.

Interpretation of historical sources

Difficulties in interpretation

There are many difficulties encountered when trying to find the locations of specific townlands in the historical documents and maps. Placenames in these documents may differ considerably in their spelling from contemporary names as they are usually based on phonetic description and may since have been anglicised e.g. *Dromonine* (Dromore), *Currymoroghoe* (Coolymurraghue), *Lorganfey* (Larkfield). There may be significant differences in old and new boundaries, due in part to legislation changes in the 18th Century which permitted the splitting of baronies. This resulted in the creation of new civil parishes and the transfer of parishes and townlands from one barony to another (Simington 1967); deciphering these changes was not always possible. In both the Civil Survey and the Down Survey only the townlands to be confiscated were documented in detail. This resulted in the frequent omission of townlands from the text and blank spaces on the Down Survey maps. In the Civil Survey and the Books of Survey and Distribution, two or more townlands were frequently grouped together, with no distinction between the land quality contained within each. For example, in the Civil Survey 'Lougheask Demesne' is listed with six other townlands from the same parish as containing '*110 acres of shrubby wood'*; without any specific reference to its location, placement of the woodland in a specific townland was not possible. Finally, the descriptiveness of the literature varies on both a county and barony basis. This is especially true for the Civil Survey.

Assignment of woodland status

Where ALEW stands could be located *with reasonable confidence* in documents or on maps which indicated that the woodland pre-dated 1660, they were classified as Possible Ancient Woodland (PAW). Thus, to be considered as PAW, stands needed woodland symbols to be noted in the correct position on the maps, and/or have text making specific reference to woodland at that location. For example, in the Book of Survey and Distribution for Co. Roscommon the following reference to *Drumharloe* [Drumharlow] townland is made: '*.....a great party woody containing 20 unprofitable acres & 43 profitable acres'*. Apart from the obvious woodland terminology, the following terms were accepted as a form of woodland '*underwood, pasturable wood, dwarf wood, scrub, boggy wood, stoney wood'* (following McCracken 1971). To assist in the location of sites, the civil parish and barony of each townland that woods occurred in was established using the '*Placenames database of Ireland*'[9]. Using this database, the archival records of each townland, where available, were examined in order to establish the earliest attested spelling.

Stands were classed as LEW (II) when no woodland symbols were observed on the maps *and* text sources to the relevant townlands were located but did not contain any specific reference to woodland. For example, the Down Survey for Co. Westmeath depicts no woodland for *Robbinstown* townland on the maps and the text reference states: *'Arable: meadow: pasture, 307 acres'*.

[9] *Bunachar Logainmneacha na hÉireann / Placenames Database of Ireland*, http://www.logainm.ie. (23rd October 2009)

All stands which could not be classified as PAW or LEW (II) were classified as LEW (I). This included stands where relevant townlands were grouped together with non-relevant townlands in the Civil Survey and the Books of Survey and Distribution, regardless of reference to woodland.

Collation of previous Irish ancient woodland studies

Previous Irish ancient woodland research was collated through a literature review and by contacting academic institutions and individuals. A summary of the results of this research is presented in Table 5 which is largely based on that of Bohan (1997).

Table 5: Summary of previous research into ancient woodlands in Ireland

NSNW No.	Woodland	County	Evidence	Reference	Status
1549	Cahiracon South	Clare	Cartography (19th C.) Written record (17th C.) Woodland structure (16th C.)	Bohan (1997)	PAW
1515	Cratloe/ Garrannon Woods	Clare	Cartography (16th/17th /18th C.) Written record (14th /15th/17th/18th C.) Palynological	Bohan (1997)	AW
1571	Killinaboy / Poulivaun Wood	Clare	Cartography (19th C.) Written record (17th C.) Woodland structure (18th C.)	Bohan (1997)	PAW
1316	Glengarriff	Cork	Cartography (16th C.) Written record (16th C.) Woodland structure (19th C.)	Bohan (1997) Little (1994)	AW
1302	Prohus	Cork	Cartography (19th C.) Woodland Structure (16th C.)	Bohan (1997)	PAW
1423	Mullangore Wood	Donegal	Written record (17th C.) Palynological	Telford (1977)	PAW
1237	St. Catherine's Wood	Dublin	Cartography (18th C.) Written record (13th/14th/16th C.) Woodland structure (16th C.)	Bohan (1997)	AW
-	Ballykine Wood	Galway	Cartography (17th C.) Written record (17th C.) Woodland Structure (17th C.)	Bohan (1997)	AW
-	Cuildermot Wood	Galway	Cartography (17th C.) Written record (17th C.) Woodland structure (18th C.)	Bohan (1997)	PAW
1601	Derryclare	Galway	Cartography (19th C.) Woodland Structure (16th C.)	Bohan (1997)	PAW
1495	Camillan Wood	Kerry	Cartography (18th C.) Written record (16th C.) Woodland structure (17th C.) Palynological	Bohan (1997) Mitchell (1988)	AW
-	Carrigawaddra Wood	Kerry	Cartography (16th C.) Written record (17th C.) Woodland structure (18th C.)	Bohan (1997)	PAW
1290	Derrycunihy Wood	Kerry	Cartography (18th C.) Written record (18th C.) Woodland Structure (18th C.) Palynological	Bohan (1997) Mitchell (1988) Little (1994)	AW
-	Glaisin na Marbh /Eamon's Wood	Kerry	Palynological Written record (18th C.)	O'Sullivan (1991)	AW

Table 5 (cont.): Summary of previous research into ancient woodlands in Ireland.

NSNW No.	Woodland	County	Evidence	Reference	Status
1291	Reenadinna Wood	Kerry	Cartography (18th C.) Written record (16th C.) Woodland structure (18th C.) Palynological	Bohan 1997) Mitchell (1990)	AW
-	Ross Island	Kerry	Cartography (16th C.) Written record (16th C.) Woodland structure (16th C.)	Bohan (1997)	AW
1289	Tomies Wood	Kerry	Cartography (16th C.) Written record (16th C.) Woodland structure (18th C.)	Bohan (1997) Little (1994)	AW
1273	Uragh Wood	Kerry	Cartography (16th C.) Woodland structure (17th C.) Palynological	Bohan (1997) Little *et al.* (1996)	AW
608	Parkhill (Abbeyleix)	Laois	Cartography (16th/17th/18th C.) Written record (18th C.) Earthworks Veteran trees	Fuller (1990) Kelly & Fuller (1988)	AW
1777	Brackloon Woods	Mayo	Written record (17th C.) Palynological	Cunningham (2000) von Engel-brechten *et al.* (2000) Little (2004)	PAW
575	Charleville North	Offaly	Cartography (16th/17th /18th C.) Written record (16th C.) Veteran trees	Fuller (1990)	AW
574	Charleville South	Offaly	Cartography (16th/17th /18th C.) Written record (16th C.) Veteran trees	Fuller (1990)	AW
-	Clonad Wood	Offaly	Cartography (16th C.) Written record (17th C.) Woodland structure (18th C.)	Bohan (1997)	AW
467	St. John's Wood	Roscommon	Written record (17th/18th C.) Presence of ancient woodland indicator species as listed by Praeger (1934) and Peterken (1981)	Fuller (1990)	AW
1400	Cullentra	Sligo	Palynological	Dodson & Bradshaw (1987)	PAW
1411	Slish Wood	Sligo	Palynological	Dodson & Bradshaw (1987)	PAW
1401	Union Wood	Sligo	Palynological	Dodson & Bradshaw (1987)	PAW
4	Killoughrum Forest	Wexford	Cartography (19th C.) Woodland structure (16h C.)	Bohan (1997)	PAW
-	Powerscourt Deerpark	Wicklow	Cartography (18th C.) Written record (16th C.) Woodland structure (16th C.)	Bohan (1997)	AW
749	Tomnafinnoge	Wicklow	Cartography (17th C.) Written record (16th/17th/18th C.) Woodland Structure (17th C.)	Bohan (1997) Wilson (1995)	AW

Supplementary research

Toponymical research

Toponymy is the study of placenames including their origins and meanings. Rackham (1995) suggested using placenames as a means to complement map and documentary evidence of a woodland's antiquity. Two aspects of placenames were examined with regard to ancient woodland status.

Translation of townland placenames

In Ireland placenames are derived from the Irish language, anglicised forms of Irish or from the English language. Gaelic placenames are thought to have originated in the 5th – 12th century (Fuller 1990). The names of townlands are particularly useful in reconstructing past landscapes, as they often hint at prominent topographical features, including woodlands or the presence of a particular tree species. Placenames alone form highly subjective evidence for woodland antiquity. However, they can provide support to map or documentary evidence.

Toponymical research was conducted on a subset of 127 sites; 41 PAW/AW sites, 26 LEW (II) sites and 60 RW sites[10]; this subset consists of NSNW sites resurveyed for the purpose of this project and other NSNW sites which met specific requirements (detailed in the 'Dataset compilation' section below). The translations for the origins and meanings of placenames were based on previous studies carried out by the '*Placenames Database of Ireland*', Joyce (1995) and Flanagan & Flanagan (2002). When a townland was not mentioned specifically by the above sources, origin was deduced where possible by translation of the component parts. Details of the results are presented in Appendix 2.

Of the 127 sites investigated, 33 sites contained a townland with a reference to woodland. References to woodlands included those that were direct (*wood of the ridge; wooded valley; wood of the planks or board),* indirect *(a place of badgers; field of the fire wood*) and those that described the composition (*little oak wood, a place abounding in holly, brook of the hazel*). Woodland placenames were noted for 40% of PAW/AW sites, 8% of the LEW (II) sites and 26% of RW sites[11]. As PAW/AW woodlands tended to have larger areas with a greater number of townlands and hence a greater chance of one containing a woodland reference, the data were also examined on a townland basis. Thus, woodland references were found in 30% of PAW/AW townland names, 5.8% of LEW (II) townland names and 20% of RW townland names[12]. It is difficult to draw many conclusions from this however, as not all placenames could be deciphered, and statistical analysis was deemed inappropriate.

Occurrence of woodland names

Rackham (1995) proposed that woodlands with their own name on historic maps or in documents are more likely to be ancient, but he found this to be rare in Ireland even amongst

[10] Note that sites may contain stands of more than one status type; sites used here were classified according to their dominant status type.

[11] Note that those sites whose townland placenames could not be deciphered were excluded from the above calculations.

[12] Note that those townlands whose placenames could be deciphered were excluded from the above calculations.

those sites with known antiquity. It can be hypothesised that woodlands with their own names on old maps had an established cultural identity at that time. However, woodland names may also indicate sites of recent origins if, for example, they are denoted as 'plantation', such as Coolnacarte Plantation in Co. Monaghan, although Westaway *et al.* (2007) suggest that this term could simply refer to underplanting in an existing stand.

For the subset of 41 PAW/AW sites and 26 LEW (II) sites, the first and third edition OS maps were examined for individual woodland names. For the third edition maps there was a significant difference in the occurrence of woodland names between PAW/AW (59% of woods) and LEW (II) (31%) according to Fisher's exact test ($p = 0.043$). The result was statistically more significant, however, for the first edition maps (Fisher exact test, $p = 0.013$) with PAW/AW sites again being more likely to be named (41% woods) than LEW (II) sites (12% woods).

Parish boundaries

A common feature of ancient woodland in Britain is that it is often associated with parish boundaries. This is because woodlands were typically cleared from the centre of parishes, close to the settlements, outwards (Kirby & Goldberg 2003; Rotherham *et al.* 2008a). However, the pattern of rural settlement in Ireland differs from that in Britain, being more dispersed and less clustered around villages. The hypothesis was tested within the Irish context in this study for the subset of 127 sites. Sites were noted that in any way touched the parish boundary or where a woodland boundary was within 100 m of the parish boundary and ran parallel to it for much of its length. It was found that there was a significant difference in the association with parish boundaries between PAW/AW sites (68% of woods), LEW (II) sites (46% woods) and RW sites (43% woods) according to a chi-square test with Yates' correction ($X^2 = 8.85$, $p = 0.012$). Whilst PAW/AW sites tended to be larger than the other woods, the difference is relatively minor compared to the size of the average parish.

Historical stand type

The relationship between broadleaf stand type as denoted on the first and third edition OS maps and ancient woodland status was investigated. Analysis focussed on the subset of 41 PAW/AW sites and 26 LEW (II) sites. Where sites consisted of more than one digitised polygon the dominant historical stand type was used. Fisher's exact test found significant differences for both first edition (PAW/AW = 56% broadleaf, LEW (II) = 29% broadleaf, $p = 0.049$) and third edition maps (PAW/AW = 61% broadleaf, LEW (II) = 29% broadleaf, $p = 0.024$).

Table 6: Sites designated as containing stands of Ancient Woodland (AW) or Possible Ancient Woodland (PAW) following desk-based research.

NSNW No.	Site Name	County	Status	NSNW No.	Site Name	County	Status
158	Altamont Gardens	Carlow	PAW	1594	Garryland Wood	Galway	PAW
183	Clogrenan Wood	Carlow	PAW	1597	Gortacarnaun	Galway	PAW
69	Toberbride	Carlow	PAW	1599	Gortnahoon	Galway	PAW
1497	Bealkelly Woods	Clare	PAW	1630	Kilbeg Lower	Galway	PAW
1549	Cahiracon South	Clare	PAW	1610	Pollnaknockaun Wood	Galway	PAW
1520	Carrowdotia South	Clare	PAW	1600	Shannawoneen Wood	Galway	PAW
1500	Dromore Nature Reserve	Clare	PAW	1495	Camillan Wood	Kerry	AW
1515	Garranon Woods	Clare	AW	-	Carrigawaddra Wood	Kerry	PAW
1571	Killinaboy/ Poulivaun Wood	Clare	PAW	1290	Derrycunihy Wood	Kerry	AW
1510	Ross	Clare	PAW	1734	Drom East	Kerry	PAW
1708	Violethill	Clare	PAW	-	Eamonn's Wood	Kerry	AW
1330	Ballyannon	Cork	AW	-	Glaisin na Marbh	Kerry	AW
1344	Blarney Castle Woods	Cork	PAW	1748	Glanageenty	Kerry	PAW
1300	Coolymurraghue	Cork	PAW	1280	Lehid Wood	Kerry	PAW
1316	Glengarriff Wood	Cork	AW	1794	Mucksna Wood	Kerry	PAW
1305	Manch East	Cork	PAW	1291	Reenadinna Wood	Kerry	AW
1302	Prohus	Cork	PAW	-	Ross Island	Kerry	AW
1308	St Gobnet's Wood	Cork	PAW	1289	Tomies	Kerry	AW
1317	The Gearagh	Cork	PAW	1273	Uragh	Kerry	AW
1426	Ardnamona Wood	Donegal	PAW	938	Carton Demense	Kildare	PAW
1422	Ballyarr Wood	Donegal	PAW	1003	Castletown	Kildare	PAW
1449	Feddyglass Wood	Donegal	PAW	927	Donadea Forest Park	Kildare	PAW
1436	Keeloges	Donegal	PAW	984	Rahin Wood	Kildare	PAW
1423	Mullangore Wood	Donegal	PAW	947	Russellswood	Kildare	PAW
1237	St. Catherine's Wood	Dublin	AW	18	Ballykeefe Wood	Kilkenny	PAW
1624	Annaghwood	Galway	PAW	308	Barleagh Wood	Kilkenny	PAW
1674	Ardbear	Galway	PAW	128	Brown's Wood	Kilkenny	PAW
-	Ballykine Wood	Galway	AW	49	Grenan Wood	Kilkenny	PAW
1602	Ballynahinch	Galway	PAW	608	Parkhill (Abbeyleix)	Laois	AW
1668	Bog Wood	Galway	PAW	263	Vicarstown	Laois	PAW
-	Cuildermot Wood	Galway	PAW	334	Garadice Lough Peninsula	Leitrim	PAW
1601	Derryclare	Galway	PAW	1709	Ballynacourty Wood	Limerick	PAW
1608	Derrycrag Wood	Galway	PAW	1286	Clare Glen	Limerick	PAW
1619	Derryvunlam	Galway	PAW	1281	Glenstal Wood	Limerick	PAW

Table 6 (cont): Sites designated as Ancient Woodland or Possible Ancient Woodland following desk-based research.

NSNW No.	Site Name	County	Status	NSNW No.	Site Name	County	Status
544	Gubroe (Castle Forbes)	Longford	PAW	1543	Glenmore Wood	Waterford	PAW
769	Kilcommock Glebe	Longford	PAW	1821	Knocknaree Wood	Waterford	PAW
1777	Brackloon Woods	Mayo	PAW	1670	Stradbally Woods	Waterford	PAW
1763	Pontoon Woods	Mayo	PAW	1819	The Grove	Waterford	PAW
1769	Raheens	Mayo	PAW	1818	White Well Wood	Waterford	PAW
575	Charleville North	Offaly	AW	1110	Cavestown	Westmeath	PAW
574	Charleville South	Offaly	AW	1097	Knockeyon Wood	Westmeath	PAW
-	Clonad Wood	Offaly	AW	102	Ballycrystal	Wexford	PAW
475	Dromcormick Wood	Roscommon	PAW	148	Ballyfad	Wexford	PAW
476	Drummans Island	Roscommon	PAW	4	Killoughrum Forest	Wexford	PAW
472	Hughestown Wood	Roscommon	PAW	514	Mountgarret	Wexford	PAW
485	Knockranny	Roscommon	PAW	746	Baltynanima	Wicklow	PAW
467	St. John's Wood	Roscommon	AW	785	Castlekevin	Wicklow	PAW
477	The Quarters	Roscommon	PAW	814	Cronroe	Wicklow	PAW
471	Warren Point	Roscommon	AW	783	Deputy's Pass	Wicklow	PAW
1404	Clogher	Sligo	PAW	775	Derrybawn	Wicklow	PAW
1400	Cullentra Wood	Sligo	PAW	922	Dunganstown West	Wicklow	PAW
1405	Kilbrattan Wood	Sligo	PAW	951	Kilcarra West	Wicklow	PAW
1411	Slishwood	Sligo	PAW	798	Kiltimon	Wicklow	PAW
1401	Union Wood	Sligo	PAW	789	Knocksink	Wicklow	PAW
1878	Drum Wood	Tipperary	PAW	-	Powerscourt Deerpark	Wicklow	AW
1861	Knockanavar Wood	Tipperary	PAW	800	Powerscourt Demense South	Wicklow	PAW
1932	Marl Bog	Tipperary	PAW	1190	Shelton	Wicklow	PAW
1839	Ballycanvan Big	Waterford	PAW	779	Shelton North	Wicklow	PAW
1816	Ballyhamlet	Waterford	PAW	781	The Devil's Glen	Wicklow	PAW
1846	Ballynatray Demesne West	Waterford	PAW	749	Tomnafinnoge	Wicklow	AW
1545	Barranamanoge Wood	Waterford	PAW	338	Vale of Clara	Wicklow	AW
1842	Cladagh	Waterford	PAW				

Table 7: Area (ha) of different status stands by current stand type

Stand type	AW	PAW	LEW (I)	LEW (II)
Semi-natural broadleaf	1,165	1,523	4,362	822
Mixed woodland	318	477	1,255	151
Conifer wood	968	1,185	2,844	141
Non-native broadleaf	4	69	408	43
Recent clearfell	167	145	784	64
Total	2,622	3,399	9,653	1,221

Summary of desk-based research

At the conclusion of the desk-study, 481 ALEW sites together with eight sites from previous research were classified as follows: 22 contained AW stands, 101 contained PAW stands and 81 contained LEW (II) stands. The remaining ALEW area was classified as LEW (I) until further evidence can prove otherwise. The 123 PAW/AW sites are listed in Table 6. The eight sites added to the dataset from previous research were digitised using the standard procedure. The total areas of the different stand types identified are presented in Table 7.

FIELD-BASED RESEARCH

Overview

Fieldwork was conducted in 23 PAW/AW and 17 LEW (II) sites with the aim of investigating differences in floral diversity, tree structure and woodland archaeological features. Work focussed only on the semi-natural broadleaf stands, i.e. PAW/AW or LEW (II) areas now under conifers, non-native broadleaves and mixed woodland were not considered. Species lists and other data from the NSNW were available for many of these stands. Due to the relatively limited resources available, fieldwork focussed on improving on these species lists rather than surveying new sites. One aim of the fieldwork was to obtain sufficient floral data for an analysis of ancient woodland vascular plant species to be conducted.

Selection of sites

Site selection for fieldwork focused on PAW/AW and LEW (II) semi-natural broadleaf stands from the NSNW that were ≥ 10 ha as it was deemed more practical to focus on larger sites. Sites were selected on the following basis:

- Seasonal bias: Fieldwork in the original NSNW was occasionally conducted quite early or late in the field season. This meant that vernal and late-flowering species were likely to be under-represented. On these grounds, it was desirable to revisit these sites in order to compile a more comprehensive list.

- Differences in NSNW site boundary and PAW/AW or LEW (II) stand boundary: The original NSNW species lists were often not specific to the PAW/AW or LEW (II) stands, since the original survey may have encompassed ancient, long-established and recent semi-natural woodland. For the original species list to be usable, an arbitrary threshold of 90% conformity between the NSNW site boundary and PAW/AW or LEW (II) stand boundary was decided upon. Where this requirement was not met, a new survey specific to the PAW/AW or LEW (II) area was needed.

Field methodology

Fieldwork was conducted over 30 days during the period 5th May - 1st July, 2009. The field methodology involved a meandering walk within the woodland area to ensure good coverage. All woodland boundaries were met and walked for some distance. To stay within the limit of the PAW/AW or LEW (II) stand boundary, fieldworkers were supplied with GPS equipment and copies of both the digitised aerial photographs and the third edition OS maps.

Species and habitat data

A comprehensive species list of vascular plant species and notable bryophytes was recorded. Nomenclature followed Stace (1997) for vascular plants and Smith (2004) for mosses. The vegetation communities present were noted and classified according to Fossitt (2000).

Woodland archaeology

This refers to the physical remains of past human activity within or relating to woodlands (Jones *et al.* 2008). The examination of these features can provide the researcher with a unique insight into the history of a woodland, and can be used to estimate longevity. Woodland archaeological features recorded in this study were chiefly wood banks, coppicing, veteran trees and agricultural remains.

Wood banks

These are a feature of old woodlands, usually constituting an earthen bank on the boundary of the woodland, and may be accompanied by an associated ditch (Ardron *et al.* 2008). The purposes of these banks were to keep out grazing animals and trespassers. Internal banks are thought to demarcate ownership or different woodland management regimes.

Coppicing

Coppicing describes the process where a tree is periodically cut to ground level to form a 'stool', from which multiple new stems grow and can be harvested. The coppicing tradition was widespread in Britain from the Middle Ages through to the late 19th century, with its wood products used both domestically and on an industrial level (Rotherham *et al.* 2008b). It is now used mainly as a nature conservation management tool. The historical extent of coppicing in Ireland remains relatively unknown, although it appears to have been at least locally abundant (Carey 2004; 2009). The frequency of old or new coppicing within a site was recorded using the scale in Table 8. The presence of large coppice stools ≥ 1m across was also noted.

Table 8: Scale for recording woodland coppicing.

Scale	Frequency
1	None observed
2	< 5% a few coppiced individuals
3	< 5% with several coppiced individuals
4	5-25% of woodland coppiced
5	26-50% of woodland coppiced
6	51-75% of woodland coppiced
7	75-100% of woodland coppiced

Veteran trees

These are trees in the mature stages of their life that are considered of biological, cultural or aesthetic interest, due to their size and/or condition (Read 2000). Veteran trees often have a large girth for their species, and may display other characteristic such as hollowed trunks, large volumes of deadwood, decay holes and sap runs (Read 2000).

In the field, potential veteran trees were identified visually and their girth at breast height (gbh) taken. Trees were considered veteran if their girth was above the threshold for their species developed by the Rural Development Service (2006) based on data from English Nature (Table 9). Smaller mature specimens which displayed a suite of other veteran characteristic were also recorded and their physical attributes noted.

Agricultural remains

The remnants of ridge and furrow ploughing and lazy beds are just some of the features which may indicate that the site was previously used for agricultural purposes, hence previously unwooded (Oswald *et al.* 2008).

Miscellaneous features

Other woodland archaeological features such as ruined buildings, stone walls, old tracks, large trees on the perimeter and quarries were also noted from the sites.

Table 9: Veteran gbh minimum inclusion thresholds

Tree Girth	**Species**
190 cm	*Betula* spp., *Crataegus monogyna*
240 cm	*Sorbus aucuparia, Salix cinerea, S. caprea, Carpinus betulus, Ilex aquifolium, Alnus glutinosa, Prunus* spp.
310 cm	*Quercus* spp., *Fraxinus excelsior, Pinus sylvestris, Ulmus* spp.
470 cm	*Tilia* spp., *Acer pseudoplatanus, Aesculus hippocastanum, Populus* spp., other *Pinus* spp., *Fagus sylvatica, Castanea sativa, Salix alba, S.fragilis*

Position in the landscape

The geographical and topographical position of each woodland was recorded, along with any associated hydrological features. Adjacent habitats and land-use were noted and classified according to Fossitt (2000).

Woodland management

The woodland's management, both past (e.g. old native, exotic broadleaf or conifer planting) and recent (e.g. planting, felling and amenity uses), was recorded, along with the presence of invasive/exotic species.

Site synopsis

Complementing the information on the field sheets, a concise site synopsis summarising woodland structure, dominant species and the pertinent features of antiquity was compiled. Management issues as well as on-site faunal activity (e.g. setts, scats, prints, sightings) were also noted.

Dataset compilation

In total, 23 PAW/AW and 17 LEW (II) stands were resurveyed. To this dataset were added a selection of PAW/AW and LEW (II) sites from the NSNW database. These additional sites were selected on the basis that they complied with the following requirements: i) 90% conformity between NSNW site boundary and PAW/AW or LEW (II) stand boundary; and ii) site was surveyed before 31st August. This increased the sample size of PAW/AW and LEW (II) to 41 and 26 stands respectively. A lower minimum area threshold of 5 ha had to be used to include these sites.

To make comparisons with recent woodland, all RW sites (i.e. sites absent from the first edition OS maps) in the NSNW database were identified. An arbitrary selection was then made of 60 sites that complied with the above requirements and were isolated from blocks of PAW, AW or LEW status. These sites were then digitised to obtain accurate areas. The resulting dataset of 127 sites contained sites from across the Republic of Ireland (Fig. 9).

Results

Species and habitat data

There were significant differences between mean species richness of different aged stand types (ANOVA, F = 4.195, df = 2, p = 0.017). PAW/AW stands were found to be significantly more species-rich than LEW (II) stands according to Tukey's *post hoc* test (Fig. 10). There were also significant differences in median area of stand between stand types (Kruskal-Wallis test, KW = 12.285, p = 0.002). RW stands were found to be significantly smaller than PAW/AW stands according to Dunn's *post hoc* test (Fig. 11).

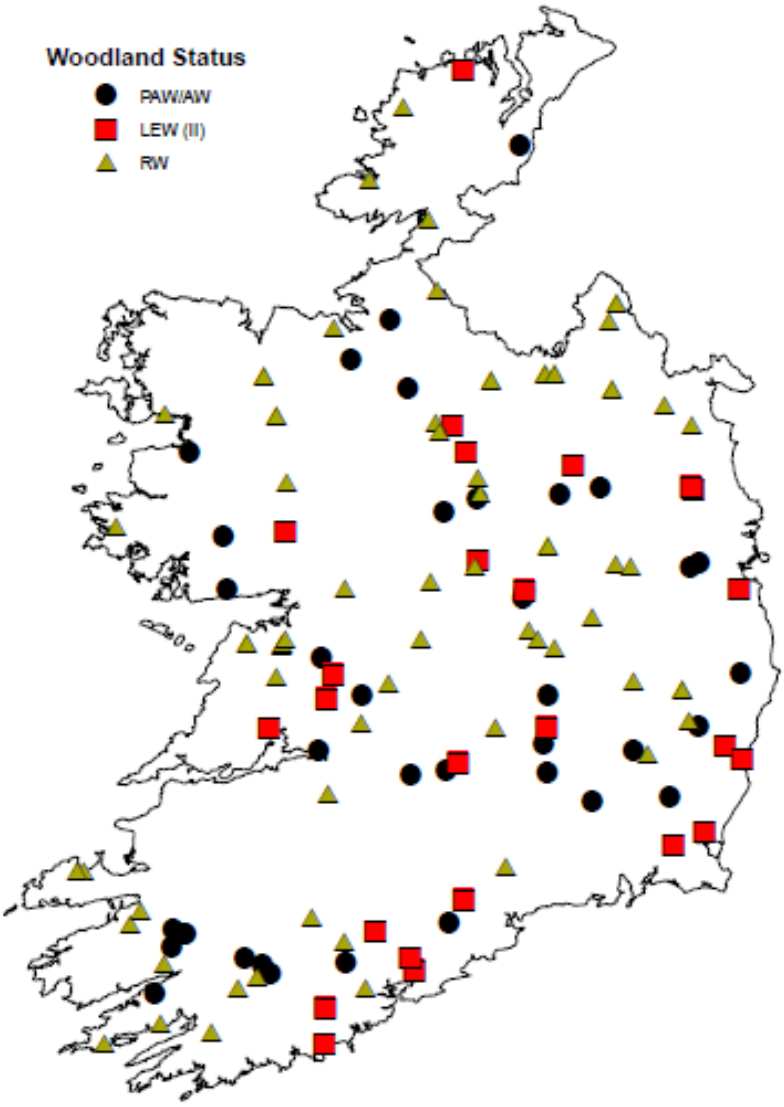

Figure 9: Distribution of PAW/AW, LEW (II) and RW sites used in this analysis

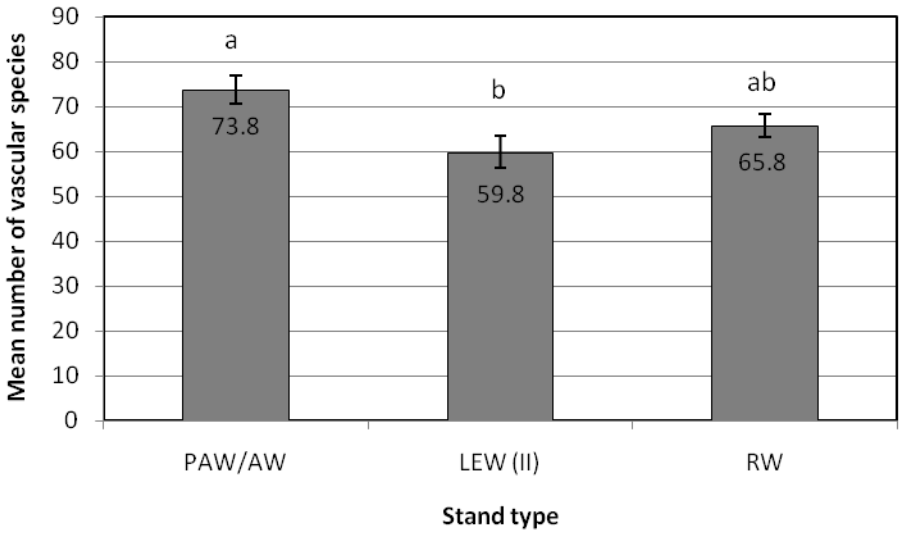

Figure 10: Mean number of vascular species in each of three stand types. Letters indicate homogenous subsets according to Tukey's *post hoc* test.

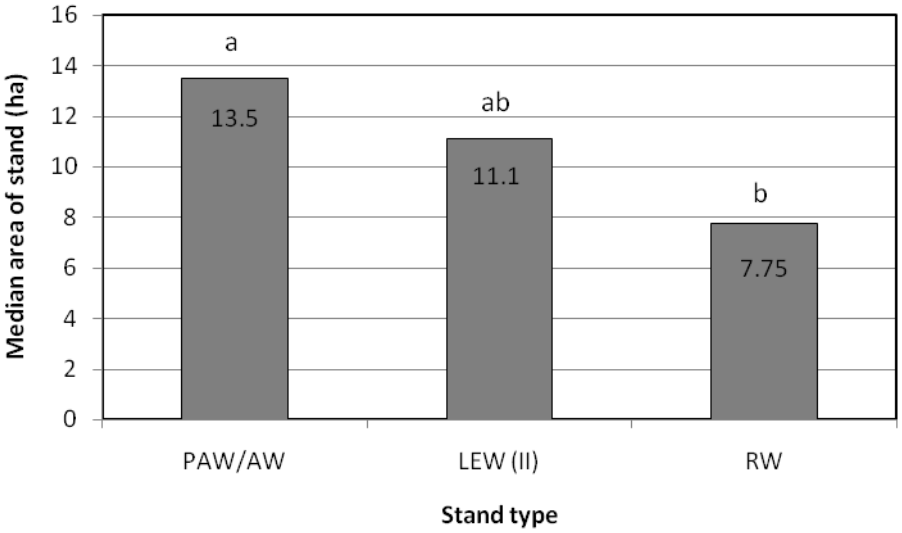

Figure 11: Median area (ha) in of stands. Letters indicate homogenous subsets according to Dunn's *post hoc* test.

Overall, the number of vascular species increased significantly overall with log (base 10) of woodland area (Spearman rank correlation, r = 0.304, n = 125, $p \leq 0.001$). For the three stand types (Fig. 12), significant correlations were found for LEW (II) sites (r = 0.425, n = 24, $p = 0.039$) and PAW/AW sites (r = 0.340, n = 41, $p = 0.030$). There was no significant correlation for RW sites (r = 0.205, n = 60, $p = 0.116$). For sites of a given size, PAW/AW site tend to be more species-rich.

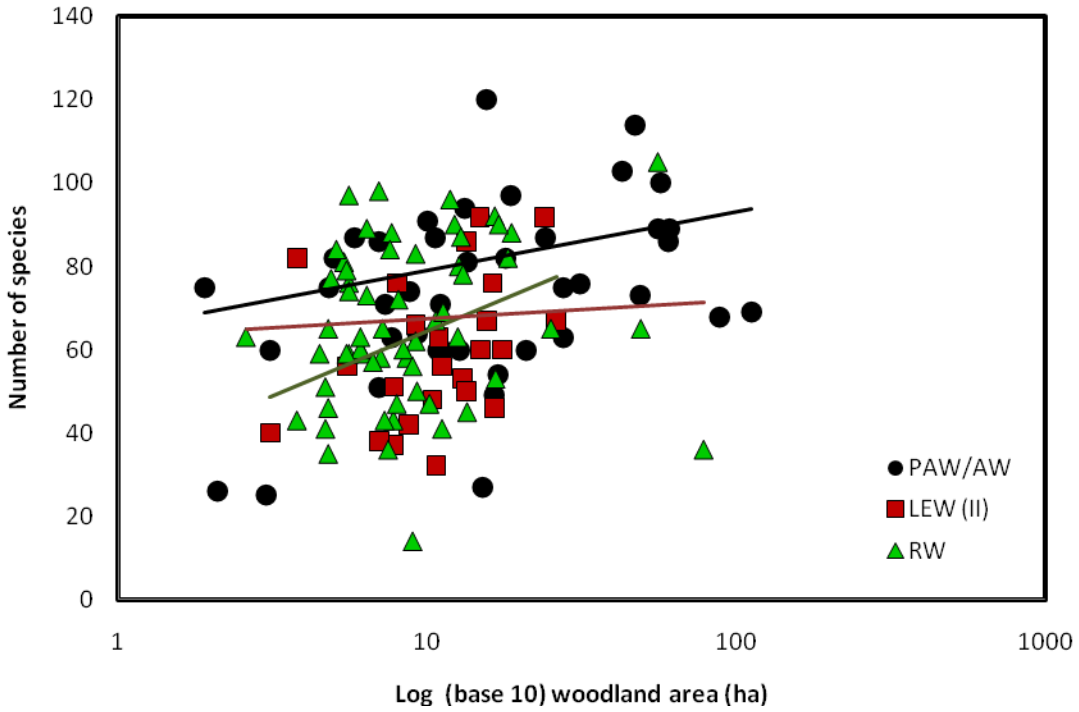

Figure 12: Relationship between number of vascular species and woodland area. Lines are linear regression trendlines.

There were some significant differences in the occurrence of woodland habitats (Table 10). WN7 Bog woodland was significantly more frequent in RW sites than in the other two categories. WD1 (Mixed) broadleaved woodland was significantly more frequent in LEW (II) stands than in either PAW/AW or RW. Non-significant differences are a higher occurrence of WN1 Oak-birch-holly woodland in PAW/AW stands and a higher frequency of WN6 wet willow-alder-ash woodland in RW stands.

Table 10: Frequency (%) of Fossitt (2000) woodland habitat types by stand type. *p* values are results of chi-square tests with Yates' correction, n.c. = not calculated due to insufficient data, italics indicate significant result.

Fossitt code	**PAW/AW n = 41**	**LEW (II) n= 26**	**RW n= 60**	***p***
WN1 Oak-birch-holly woodland	51.2	30.8	30.0	0.125
WN2 Oak-ash--hazel woodland	31.7	30.8	31.7	0.975
WN3 Yew woodland	0.0	0.0	0.0	n.c.
WN4 Wet pedunculate oak-ash woodland	9.8	7.7	6.7	n.c.
WN5 Riparian woodland	0.0	0.0	0.0	n.c.
WN6 Wet willow-alder-ash woodland	17.1	19.2	33.3	0.228
WN7 Bog woodland	4.9	0.0	36.7	*<0.001*
WS1 Scrub	0.0	7.7	8.3	n.c.
WD1 (Mixed) broadleaved woodland	19.5	65.4	8.3	*<0.001*
WD2 Mixed broadleaved/conifer woodland	2.4	3.8	1.7	n.c.

Woodland archaeology

Statistics in this section pertain only to 23 PAW/AW stands and 17 LEW (II) stands surveyed as part of this project.

Coppicing

Evidence of coppicing was noted from 91% of PAW/AW stands and 76% of LEW (II) stands. This difference was not significant according to a Fisher's exact test (p = 0.373). The presence of large coppice stools, however, was significantly more common in PAW/AW stands (52 %) than in LEW (II) stands (12%) (Fisher's exact test, p = 0.017). The level of coppicing observed was also significantly higher on PAW/AW sites (median = 3.2) than on LEW (II) sites (median = 2.5) (Mann-Whitney U-test, U = 129, p = 0.063). Coppice species included *Quercus robur*, *Q. petraea*, *Fraxinus excelsior*, *Corylus avellana*, *Salix caprea*, *Sorbus aucuparia, Castanea sativa* and *Carpinus betulus.*

Veteran trees

Veteran trees were equally common in both types of woodland, being present in 65% of PAW/AW stands and 65% of LEW (II) stands. The veteran tree species included *Quercus robur, Fagus sylvatica, Betula pubescens, Acer pseudoplatanus, Tilia* x *europaea* and *Salix caprea.*

Wood banks

Wood banks (with or without a ditch) were evident on at least part of the boundary in the majority of woodlands surveyed. They were found in 78% of PAW/AW stands and 59% of LEW (II) stands; this was not a significant difference (Fisher's exact test, p = 0.622). This result agrees in part with Rackham's (1985) observations that any woodland greater than 100 years old in Britain contained some sort of boundary earthwork around their edge. Another common feature were internal banks (with or without a ditch) which were noted in 48% of the PAW/AW stands and 35% of the LEW (II) stands; again this was not a significant difference (Fisher's exact test, p = 0.525). Earthwork features were notably absent from sites with steep topography, an observation which was also noted by Hill (2003).

Other archaeology features included large perimeter trees, which were noted from 17% of the PAW/AW stands and 23% of the LEW (II) stands. The remnant of a ridge and furrow system was noted from two sites, including St. Johns Wood, Co. Roscommon and Balrath, Co. Meath. Historical quarries were a feature of Blarney Castle Woods, Co. Cork, and the esker woodland in Cavestown, Co. Westmeath

Position in the landscape

There were significant differences in the topography of the landscape in which different stand types occurred (Table 11). RW stands tended to be less frequent on sloping ground than PAW/AW and LEW (II) and rather more frequent on flat ground. This is likely to be due to many RW stands being degraded raised bog sites.

Table 11: Frequency (%) of different topography by stand type. *p* values are results of chi-square tests with Yates' correction, n.c. = not calculated due to insufficient data, italics indicate significant result

Topography	**PAW/AW n = 41**	**LEW (II) n= 26**	**RW n= 60**	***p***
Flat	56.1	50.0	71.7	0.175
Summit	22.0	7.7	3.3	*0.003*
Upper slope	31.7	50.0	13.3	*<0.001*
Mid-slope	56.1	61.5	40.0	*0.035*
Terraced slope	2.4	3.8	3.3	n.c.
Lower slope	56.1	53.8	36.7	*0.037*
Depression	7.3	0.0	1.7	n.c.

Summary of field-based research

Ancient woodland stands tend to be larger than more recent woodlands and support proportionately more species for their size. Recent woodland tends to contain bog woodland or wet woodland habitats and occur on flatter ground. Long-established woodland is more likely to contain modified woodland and ancient woodland has a tendency to contain acid oak woodland stands. The occurrence of veteran trees and internal/external ditches appears to be poor at differentiating between ancient and long-established stands. However, large coppice stools and more extensive coppicing appear to be characteristic of ancient woodlands sites.

Plate 1: Veteran trees, coppice and wood banks. © Thérèse Higgins (a.c), Orla Daly (b), Kate McNutt (d.g), Simon Barron (e), Fionnuala O'Neill (f)

a.Veteran tree, Derrycunihy, Co. Kerry.

b. Veteran tree, Warren Point, Co. Roscommon.

c. Veteran tree, Uragh, Co. Kerry.

d. Coppice ring, Maryfort, Co. Clare.

e. Coppice stool, the Gearagh, Co. Cork.

f. Wood bank, Ballyhamlet, Co. Waterford.

g. Wood bank and ditch, Caher Rice, Co. Clare.

ANCIENT WOODLAND INDICATORS

Overview

Species lists from ancient, long-established and recent woods recorded during this project and the NSNW were analysed to identify ancient woodland indicators. The aim was to use a statistical approach similar to that used in Northern Ireland (Anon. 2007) rather than the subjective approach of expert opinion such as has been used in Scotland (Crawford 2009). However, it was recognised that an assessment of putative indicators produced by the analysis would be required for practical purposes. The resulting list of species was compared with lists from Ireland and Britain and the application of ancient woodland indicators in Ireland was reviewed.

Data preparation

Species lists were compiled for the subset of 41 PAW/AW stands, 24 LEW (II) stands and 60 RW stands (as detailed in the 'Data compilation' section previously) with the omission of 2 LEW(II) stands. All species data were recorded between mid-April and the end of August and all sites were over 5 ha in area. The aim was to identify ancient woodland vascular plants (AWVPs); data for bryophytes, lichens and non-native plants were excluded. For tree species, records from different stratigraphical layers were combined. Only records identified to species level were used; records identified to genus level (e.g. *Carex* sp.) were excluded. Records for *Viola riviniana* and *V. reichenbachiana* were combined due to standard identification difficulties.

Analysis methodology

Frequencies of species in PAW/AW and RW stands were analysed using Fisher's exact test. Habitat preferences for species with statistically significant results were examined using the Broad Habitats Classification of Hill *et al.* (2004). Species that are listed by Hill *et al.* (2004) only for woodland habitat were denoted as woodland specialists. Species that are listed for both woodland and non-woodland habitats were denoted as woodland generalists. Species that are not listed for woodland habitat were denoted as non-woodland species. Patterns in habitat preference were then analysed using a chi-square test with Yates' correction. Frequencies of occurrence for this subset of species in PAW/AW and LEW (II) stands were also analysed using Fisher's exact test. ANOVA was used to analyse the mean number of indicators. Spearman rank correlation was used to test relationships between log (base 10) of area of woodland and the number of indicator species.

Results

Of the 359 vascular plant species that were recorded in the PAW/AW and RW stands, a total of 50 species were found to have statistically significant frequencies of occurrence. Of these, 36 species favoured PAW/AW stands (Table 12) and 14 favoured RW stands (Table 13). Only five of these species were found to have statistically different frequencies between PAW/AW and LEW (II) stands. The chi-square test found significant differences in habitat preferences between the two groups of indicators ($X^2 = 14.622$, $p \leq 0.001$; Table 14), with the species favouring PAW/AW stands being mainly woodland specialists and woodland generalists, and the species favouring RW stands being mainly non-woodland species.

Table 12: Species significantly more frequent in PAW/AW stands than in RW stands. Percentage frequency in three different stand types is shown. *p* values indicate results of Fisher's exact tests. WS = woodland specialist, WG = woodland generalist, NWS = non-woodland species. n.s. = not significant.

Species	**% PAW /AW**	**% LEW (II)**	**%RW**	***p* PAW/AW vs RW**	***p* PAW/AW vs LEW (II)**	**Habitat**
Species retained as indicators						
Ajuga reptans	73.2	66.7	35.0	<0.001	n.s.	WS
Allium ursinum	26.8	25.0	6.7	0.008	n.s.	WS
Anemone nemorosa	56.1	41.7	18.3	<0.001	n.s.	WG
Arbutus unedo	9.8	0.0	0.0	0.023	n.s.	WG
Cardamine flexuosa	73.2	54.2	51.7	0.041	n.s.	WS
Carex sylvatica	82.9	75.0	48.3	<0.001	n.s.	WS
Conopodium majus	61.0	50.0	31.7	0.007	n.s.	WG
Corylus avellana	90.2	87.5	61.7	0.002	n.s.	WG
Dryopteris aemula	41.5	16.7	18.3	0.012	n.s.	WG
Euonymus europaeus	41.5	41.7	20.0	0.024	n.s.	WG
Euphorbia hyberna	24.4	0.0	8.3	0.042	0.010	WG
Galium odoratum	31.7	16.7	5.0	0.004	n.s.	WS
Geum rivale	31.7	25.0	5.0	<0.001	n.s.	WG
Glechoma hederacea	41.5	45.8	15.0	0.009	n.s.	WG
Hyacinthoides non-scripta	75.6	70.8	46.7	0.007	n.s.	WG
Hypericum androsaemum	56.1	37.5	28.3	0.006	n.s.	WG
Luzula sylvatica	68.3	54.2	25.0	<0.001	n.s.	WG
Lysimachia nemorum	68.3	54.2	43.3	0.024	n.s	WS
Malus sylvestris	34.1	16.7	15.0	0.029	n.s	WG
Oxalis acetosella	85.4	79.2	66.7	0.040	n.s.	WG
Populus tremula	9.8	8.3	0.0	0.023	n.s.	WG
Potentilla sterilis	75.6	58.3	48.3	0.012	n.s.	WS
Quercus petraea	58.5	50.0	30.0	0.008	n.s.	WS
Ranunculus ficaria	56.1	62.5	31.7	0.013	n.s.	WG
Rumex sanguineus	61.0	62.5	35.0	0.023	n.s.	WS
Silene dioica	14.6	0.0	2.0	0.016	n.s.	WS
Stellaria holostea	51.2	33.3	18.3	0.002	n.s.	WS
Ulmus glabra	41.5	54.2	13.3	0.004	n.s.	WS
Veronica montana	78.0	83.3	41.7	<0.001	n.s.	WS
Species excluded on ecological grounds						
Betula pendula	24.4	12.5	8.3	0.042	n.s.	WS
Arctium minus	19.5	4.2	3.3	0.028	n.s.	NWS
Festuca rubra	19.5	8.3	3.3	0.013	n.s.	NWS
Hymenophyllum tunbrigense	22.0	0.0	5.0	0.012	0.021	NWS
Plantago lanceolata	26.8	8.3	8.3	0.042	n.s.	NWS
Potentilla reptans	19.5	0.0	5.0	0.025	0.022	NWS
Stachys sylvatica	41.5	45.8	21.7	0.046	n.s.	NWS

Table 13: Species significantly more frequent in RW stands than in PAW/AW stands. Percentage frequency in three different stand types is shown. *p* values indicate results of Fisher's exact tests. WS = woodland specialist, WG = woodland generalist, NWS = non-woodland species. n.s. = not significant.

Species	**% PAW/AW**	**% LEW (II)**	**%RW**	***p* PAW/AW vs RW**	***p* PAW/AW vs LEW**	**Habitat**
Calystegia sepium	4.9	4.2	23.3	0.004	n.s.	NWS
Carex echinata	9.8	4.2	31.7	0.015	n.s.	NWS
Carex paniculata	4.9	0.0	21.7	0.024	n.s.	WG
Carex rostrata	0.0	0.0	11.7	0.040	-	NWS
Epilobium montanum	22.0	33.3	43.3	0.019	n.s.	NWS
Equisetum fluviatile	7.3	12.5	25.0	0.033	n.s.	NWS
Galium palustre	46.3	16.7	68.3	0.039	0.018	NWS
Juncus acutiflorus	2.4	0.0	16.7	0.046	n.s.	NWS
Molinia caerulea	26.8	0.0	58.3	0.004	0.005	NWS
Potentilla palustris	4.9	0.0	20.0	0.041	n.s.	NWS
Rumex acetosa	2.4	8.3	26.7	0.002	n.s.	NWS
Salix aurita	4.9	8.3	23.3	0.024	n.s.	WG
Salix cinerea	66.7	68.3	90.0	0.008	n.s.	WG
Ulex europaeus	39.0	29.2	22.0	0.014	n.s.	NWS

Table 14: Relationship between habitat preference and number of species statistically associated with woodland type

Woodland type	**Woodland specialist**	**Woodland generalist**	**Non-woodland species**
Possible Ancient Woodland /Ancient Woodland	14	16	6
Recent Woodland	0	3	11

For the species associated with RW sites the main non-woodland habitat listed by Hill *et al.* (2004) is fen, swamp and marsh (64% of species). For the woodland generalist species associated with PAW/AW stands the main non-woodland habitats listed are boundary and linear features (hedgerows, tree-lines and walls, 47% of species) and inland rock (40% of species). Of the non-woodland species associated with PAW/AW stands, *Potentilla reptans* and *Plantago lanceolata* are only listed for grassland habitats, *Hymenophyllum tunbrigense* for inland rock, *Arctium minus* and *Stachys sylvatica* for boundary and linear features, and *Festuca rubra* for grassland, littoral sediment and inland rock. AWVPs are ideally species dependent on woodlands and which seldom occur outside this habitat. Non-woodland species are therefore unlikely to be diagnostic of woodland continuity. AWVPs are also characteristically poor colonisers with limited dispersal ability. On these bases it was decided to exclude the six non-woodland species and *Betula pendula* from the list of indicators despite the statistical significance.

The mean number of indicator species differed significantly with stand type (Fig. 13, ANOVA, F = 23.923, df = 2, n = 125, $p \leq 0.001$). Both LEW (II) and PAW/AW stands held more indicator species than RW stands, but there was no significant difference between LEW (II) and PAW/AW stands according to Tukey's *post hoc* test.

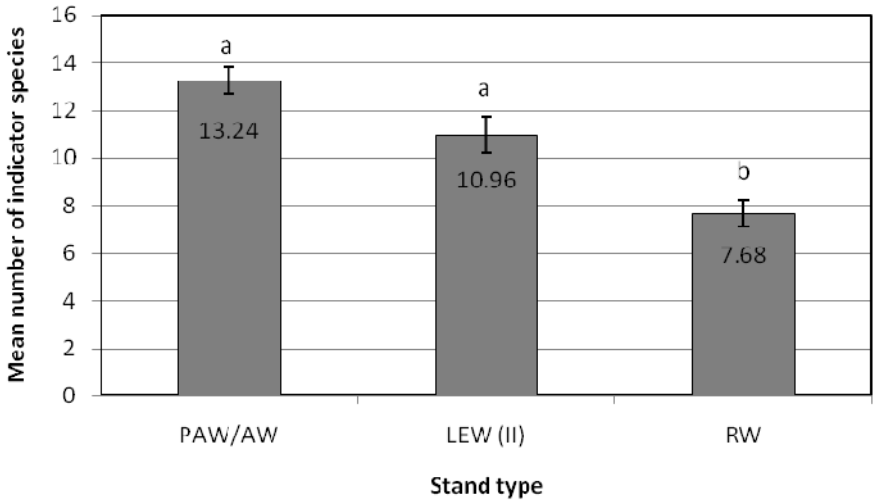

Figure 13: Mean number of indicator species in each of three stand types. Letters indicate homogenous subsets according to Tukey's *post hoc* test.

The number of indicator species increased significantly overall with woodland area (Spearman rank correlation, r = 0.366, n = 125, $p \leq 0.001$). For the three stand types (Fig. 14), almost significant correlations were found for LEW (II) (r = 0.403, n = 24, $p = 0.051$) and PAW stands (r = 0.273, n = 41, $p = 0.084$), but no significant correlation for RW stands (r = 1.499, n = 60, $p = 0.253$).

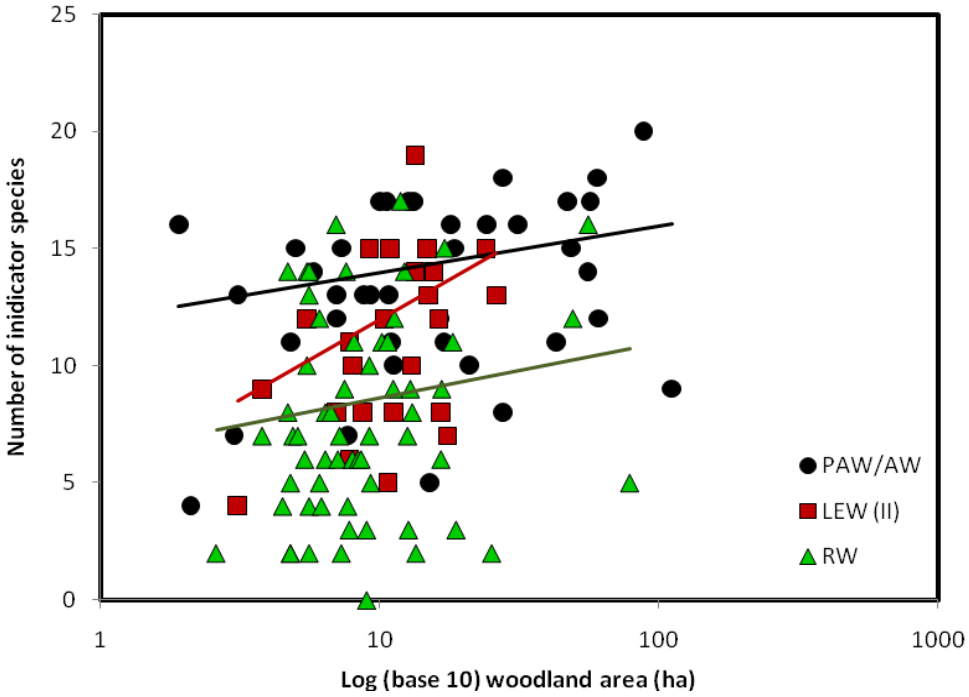

Figure. 14: Relationship between number of indicator species and woodland area. Lines are linear regression trendlines.

Relevé data from the NSNW (Perrin *et al.* 2008; Table 15) shows that the large majority of indicator species (24 species) are most frequently found in *Fraxinus excelsior – Hedera helix* woodland and *Quercus petraea – Luzula sylvatica* woodland. These groups essentially represent dry, base-rich woodland and acid oak woodland respectively. Only five indicator species are most frequently found in the wet woodlands of the *Alnus glutinosa – Filipendula ulmaria* woodlands or the degraded bog or successional stands found in the *Betula pubescens – Molinia caerulea* woodland group.

Table 15: Percentage frequency of indicator species in the relevés for the four woodland groups defined by the *National Survey of Native Woodlands 2003-2008*

Indicator species	**Group 1**	**Group 2**	**Group 3**	**Group 4**
Species most frequent in Group 1: *Quercus petraea – Luzula sylvatica* woodland				
Quercus petraea	99.2	9.3	5.7	17.0
Luzula sylvatica	63.1	11.9	4.4	11.1
Oxalis acetosella	58.1	33.0	18.6	23.5
Dryopteris aemula	20.0	3.6	3.0	5.7
Stellaria holostea	8.5	4.6	1.0	1.9
Hypericum androsaemum	5.0	3.1	2.0	1.1
Euphorbia hyberna	3.1	1.2	0.0	0.0
Malus sylvestris	2.3	2.3	2.0	1.1
Arbutus unedo	0.4	0.1	0.0	0.0
Species most frequent in Group 2: *Fraxinus excelsior – Hedera helix* woodland				
Corylus avellana	53.1	62.0	22.3	18.1
Hyacinthoides non-scripta	26.2	37.0	5.1	5.7
Veronica montana	5.4	28.2	17.2	3.8
Potentilla sterilis	7.7	27.0	10.5	1.1
Carex sylvatica	11.5	26.5	16.2	5.9
Lysimachia nemorum	6.9	16.4	16.2	6.2
Conopodium majus	5.8	15.4	1.4	0.5
Euonymus europaeus	0.4	15.0	8.1	0.5
Ranunculus ficaria	3.8	11.6	8.4	2.4
Ulmus glabra	0.8	10.8	2.4	0.3
Glechoma hederacea	0.8	8.8	6.8	0.0
Anemone nemorosa	6.2	7.2	4.7	1.1
Allium ursinum	2.3	6.1	0.7	0.0
Galium odoratum	0.4	2.3	0.3	0.3
Silene dioica	0.4	0.5	0.0	0.3
Species most frequent in Group 3: *Alnus glutinosa – Filipendula ulmaria* woodland				
Cardamine flexuosa	2.7	8.9	28.4	6.5
Rumex sanguineus	0.8	18.1	24.7	2.7
Ajuga reptans	6.5	14.1	16.2	2.4
Geum rivale	0.0	1.9	5.7	0.5
Species most frequent in Group 4: *Betula pubescens – Molinia caerulea* woodland				
Populus tremula	0.0	0.0	0.0	0.3

Plate 2: Ancient woodland vascular plants. © Orla Daly (a), Philip Perrin (b.d), Fionnuala O'Neill (c,g,h), Kate McNutt (e), Thérèse Higgins (f)

a. ***Ajuga reptans*** **b.** ***Ranunculus ficaria*** **c.** ***Euphorbia hyberna***

d. ***Allium ursinum*** **e.** ***Hyacinthoides non-scripta***

f. ***Anemone nemorosa*** **g.** ***Geum rivale*** **h.** ***Galium odoratum***

Discussion

Praeger (1934) presents a list of eight vascular plant species associated with older woodland (Table 16). These are very similar to the species proposed by Henry (1914). Of these plants, four species were not recorded in the 125 sites analysed here. Of the four species that were recorded, all were exceptionally rare, with the exception of *Neottia nidus-avis,* and no significant patterns of occurrence were found.

Tables 16: Species proposed by Praeger (1934) as associated with older woodland. WS = woodland specialist, WG = woodland generalist, NWS = non-woodland species.

Species	% PAW/AW	% LEW (II)	%RW	Habitat
Neottia nidus-avis	9.8	4.2	3.3	WS
Lathraea squamaria	4.9	0.0	0.0	WG
Monotropa hypopitys	0.0	0.0	0.0	WS
Cephalanthera longifolia	0.0	0.0	1.7	WS
Millium effusum	2.4	0.0	1.7	WS
Festuca altissima	0.0	0.0	0.0	WG
Pyrola media	0.0	0.0	0.0.	NWS
Pyrola minor	0.0	0.0	0.0	WG

The *Back on the Map* project in Northern Ireland presented a list of 41 ancient woodland indicators in their provisional report (Anon. 2007). A revised list of 63 species comprising 49 vascular plants (Table 17) and 14 bryophyte species has since been published on the project website[11]. These species were found to be statistically significantly associated with ancient woodland rather than with long-established woodland. There are 14 species found only on the list for the Republic of Ireland, 15 species common to both lists and 34 species found only on the list for Northern Ireland. Of these 34 last species, 12 plants are listed as non-woodland species by Hill *et al.* (2004) and two further species (*Galium palustre* and *Salix cinerea*) were found to be positively associated with recent woodland by the present study. A further three species found only on the Northern Ireland list, *Lonicera periclymenum*, *Geranium robertianum* and *Hedera helix*, occurred at over 80% of sites of the NSNW in the Republic. *Betula pubescens* is also included on the Northern Ireland list, but in common with *B. pendula* this species is characteristically a pioneer species.

Several species that occur on the Irish lists are absent from the AWVP lists for Britain compiled by Kirby (2004). These equate to 24% of the list for the Republic and comprise *Ajuga reptans, Arbutus unedo, Cardamine flexuosa, Euphorbia hyberna, Glechoma hederacea, Ranunculus ficaria* and *Rumex sanguineus*. From the list for Northern Ireland, 39% of species are absent from the British lists. Species on the list from the present study which feature strongly in the British lists (> 60% of lists) include *Allium ursinum, Anemone nemorosa, Carex sylvatica, Galium odoratum, Luzula sylvatica, Lysimachia nemorum, Oxalis acetosella* and *Veronica montana.*

[11] "Ancient woodland species". *Back on the Map.* (23rd October 2009). http://www.backonthemap.org.uk/theproject/analysis/species.htm.

Table 17: Comparison of species proposed as AWVPs with those proposed for woodlands in Northern Ireland by the Woodland Trust. Hab = Habitat where WS = woodland specialist, WG = woodland generalist, NWS = non-woodland species. Ire = % sites in the National Survey of Native Woodlands 2003-2008 (Perrin *et al.* 2008) at which each species occurs. GB = number of 14 British regional lists presented by Kirby (2004) in which each species occurs.

Rep. of Ireland list only	**Hab**	**Ire**	**GB**
Allium ursinum	WS	9.3	9
Arbutus unedo	WG	0.5	0
Dryopteris aemula	WG	15.1	4
Euonymus europaeus	WG	24.4	6
Euphorbia hyberna	WG	6.7	0
Geum rivale	WG	5.7	7
Glechoma hederacea	WG	27.4	0
Hypericum androsaemum	WG	32.0	6
Malus sylvestris	WG	16.8	5
Quercus petraea	WS	33.9	6
Populus tremula	WG	5.0	6
Rumex sanguineus	WS	51.8	0
Silene dioica	WS	3.0	1
Ulmus glabra	WS	27.7	2

Common to both lists	**Hab**	**Ire**	**GB**
Ajuga reptans	WS	42.1	0
Anemone nemorosa	WG	17.5	11
Cardamine flexuosa	WS	47.0	0
Carex sylvatica	WS	56.0	11
Conopodium majus	WG	29.0	7
Corylus avellana	WG	70.2	1
Galium odoratum	WS	9.3	13
Hyacinthoides non-scripta	WG	52.3	8
Luzula sylvatica	WG	34.7	10
Lysimachia nemorum	WS	45.4	9
Oxalis acetosella	WG	59.6	9
Potentilla sterilis	WS	46.4	7
Ranunculus ficaria	WG	20.8	0
Stellaria holostea	WS	27.8	3
Veronica montana	WS	46.6	10

Northern Ireland list only	**Hab**	**Ire**	**GB**
Arum maculatum	WS	41.9	1
Betula pubescens	WS	72.4	0
Blechnum spicant	WG	56.1	5
Brachypodium sylvaticum	WS	55.5	2
Carex remota	WG	57.3	10
Chrysosplenium oppositifolium	WG	50.1	10
Circaea lutetiana	WS	65.5	0
Crepis paludosa	NWS	7.4	0
Digitalis purpurea	NWS	32.7	0
Dryopteris affinis	WG	69.6	6
Galium palustre	NWS	47.3	0
Geranium robertianum	WG	83.2	1
Geum urbanum	WG	71.6	0
Glyceria fluitans	NWS	24.5	0
Hedera helix	WG	96.5	0
Hypericum pulchrum	NWS	26.6	8
Lapsana communis	NWS	23.9	0
Lonicera periclymenum	WS	84.5	1
Luzula pilosa	WG	7.2	12
Mentha aquatica	NWS	36.8	0
Orchis mascula	WG	6.1	8
Polypodium interjectum	WG	2.2	0
Polystichum aculeatum	WG	1.4	9
Prunus spinosa	NWS	61.1	0
Salix caprea	WS	25.2	1
Salix cinerea	WG	78.2	0
Rosa canina	WG	28.7	0
Sanicula europaea	WS	43.5	9
Senecio aquaticus	NWS	24.3	0
Sorbus aucuparia	WG	55.6	1
Stellaria uliginosa	NWS	14.1	0
Vaccinium myrtillus	NWS	34.3	4
Valeriana officinalis	NWS	28.5	1
Viola riviniana	WG	65.4	2

There are also, however, strong British indicator species that occur only on the Northern Ireland list, namely *Carex remota, Chrysosplenium oppositifolium, Luzula pilosa, Polystichum aculeatum* and *Sanicula europaea.* Further work may prove these to be of value as indicators in the Republic.

The list presented by the current study is shorter than most of those for the British regions presented by Kirby (2004), e.g. Derbyshire 98 species, Worcestershire 105 species, Eastern England 108 species, Lincolnshire 65 species. This is in part due to the depauperate nature of the Irish flora in comparison with Britain and the absence of many true woodland specialists. Webb (1983) estimated that Ireland had only 71.5% as many flowering plants as Britain. As AWVP are characteristically poor colonisers it may be hypothesised that Ireland will have proportionately fewer of this type of species. Of the 190 AWVPs listed by Kirby (2004), 58 species (31%) are absent from the Republic or occur only as aliens and a further 19 species (10%) are very rare[12].

From the present data it is difficult to differentiate floristically between ancient and long-established woodland. There is a trend for indicators to be more frequent at PAW/AW stands than LEW (II) stands but it is not significant. This may be due to the difficulties of accurately assigning sites to PAW/AW and LEW (II) categories from the documentary evidence and consequently the rather small LEW (II) sample size. It may also reflect genuinely minor floristic differences between these sites as a result of Ireland's small pool of woodland specialists.

In terms of application, it is important to remember that almost all indicator species have been recorded from each of ancient, long-established and recent woodland sites. Identification of ancient woodland in the field should not therefore be based on the occurrence of a single species. A suite of AWVPs provides much better evidence. Overall, the number of AWVPs increased with woodland size. Therefore the threshold number of species required to reasonably describe a wood as ancient should also increase with area. To reduce the chances of misclassification of LEW (II) or RW sites, provisional guidance is a conservative threshold of 16 species for sites ≥ 10 ha and and 12 species for sites < 10 ha. The application of these thresholds to the subset of 125 sites is presented in Table 18. These thresholds correctly classify the large majority of RW and LEW (II) sites, but only correctly classify 53.7% of PAW/AW sites. Therefore where sufficient AWVPs are not recorded on a site it is recommended that other evidence is carefully examined before rejecting the site as ancient woodland.

Table 18: Application of AWVP thresholds to identifying ancient woodland.
Figures are % within each size class

Woodland area	**RW**		**LEW (II)**		**PAW/AW**	
	Correct	Misclassified	Correct	Misclassified	Correct	Misclassified
< 10 ha (≥ 12 AWVPs)	87.5%	12.5%	77.8	22.2	69.2%	30.8%
≥ 10 ha (≥ 16 AWVPS)	90.0%	10.0%	100.0	0.0	46.4%	53.6%
All sites	88.0%	12.0%	91.7%	8.3%	53.7%	46.3%

[12] Very rare denotes fewer than ten 10 km x 10 km square records for 1987-1999 in the *New Atlas of the British and Irish Flora* (Preston *et al.* 2002)

CONCLUSIONS

Overview

The original aims of this project have been fulfilled using a combination of historical data and modern techniques to identify Irish woodland sites with a long history of woodland cover. A *National Ancient and Long-established Woodland Inventory* has been initiated in the form of a GIS database. Some examples from this database are presented in Appendix 3. Toponymical, historical stand type, archaeological and topographical evidence were also incorporated into the study as a means to promote a multidisciplinary approach to the study of ancient woodlands.

A list of 123 sites containing PAW or AW stands has been compiled through the combination of historical national surveys, maps and previous Irish ancient woodland research. A further list of 335 LEW (I) sites presented by this research represents a resource from which future ancient woodlands could be identified. It is important that these sites get similar recognition to PAW/AW sites based on the precautionary principle. The way in which these sites were dealt with in the English and Welsh Ancient Woodland Inventory was to consider them ancient unless historical records could prove otherwise. This inclusive approach reduced incidents of sites being dismissed as less important for nature conservation should evidence of antiquity not be available at a particular time (Spencer & Kirby 1992).

Historical documents

No complete account of the woodlands of Ireland in the 17th century is in existence, rather the evidence exists in fragmentary form scattered throughout the archives, with evidence becoming more frequent in the 18th century.

The historical national surveys examined do not represent a comprehensive resource for woodland study, highlighted by the failure to classify 337 of the sites. The Civil Survey only covers nine of the 26 counties and the Down Survey only 15 counties, with little or no woodland information contained in the Books of Survey and Distribution, except for the Connaught counties. The lack of descriptions of unfortified lands and omissions of certain baronies also presented a problem. It is recognised that failure to correctly identify townlands within the context of historical boundaries hampered the full use of these resources, and a prior investigation of this element is recommended for future inventories. Despite this, these records do represent a solid basis from which more detailed inventories can develop for those counties comprehensively covered. These records can also locate those smaller blocks of ancient woodland which are often omitted from county and provincial maps. The identification and subsequent conservation of these smaller blocks of remnant ancient woodlands is highly important given the very low national resource of ancient woodland.

County and provincial maps such as those investigated in this study and preceding studies (Fuller, 1990; Little 1994; Bohan 1997) were a useful complement to the documentary evidence. Many general and provincial maps are noted only to include landmark woodlands. Therefore, the absence of a woodland from these maps should not be used to indicate that the wood was not present. One of the main problems with cartography is representing vertical features on a

horizontal plane (Bohan 1997), a phenomenon which may have led to the under-representation of valley and mountain woodlands. This was noted from Nevill's map, which was set within the complex topography of Co. Wicklow, and it is likely that the depiction of contours were given prevalence over tree symbols in many cases.

Other relevant historical documents, brought to attention by previous authors are presented in this study. These represent an important resource for future ancient woodland researchers and are a useful complement for counties that are poorly represented by the main historic national surveys (e.g. for Co. Kerry, the Munster plantation surveys from 1584 may be a useful substitute).

Woodland archaeology

The woodland archaeology noted during the field surveys seems to indicate that Irish woodlands were managed in a similar fashion to British woodlands, with the majority of sites containing earthworks and evidence of coppice. The high number of veteran trees recorded highlights the importance of these habitats for a variety of other taxa, including lichens, fungi and invertebrates (Bee 2008). The list of PAW/AW sites presented in this study represents a unique research opportunity to study these taxa. The presence of large coppice stools and more extensive coppicing systems may be the characteristics that can help to differentiate ancient woodland from those woods that appeared after 1660. Care must be taken, however, not to misinterpret regrowth from once-off felling events as evidence of a systematic coppice regime. Agricultural features such as ridge and furrow may have been under-recorded in this study, as many of the sites were visited during the peak growing season and their presence concealed by the dense vegetation. Although not directly examined here, there are a number of other archaeology indicators which can give an insight into of past woodland management. These include the remnants of charcoal making platforms, iron work and lime production; these features may occur within the woodland itself or in the surrounding landscape (Byrne 2004). The identification of these features in the field requires a certain degree of training.

Historical OS maps and toponymical research

The historical OS maps represent an important resource that can be utilised in the identification of PAW/AW, with general trends indicating that ancient woodlands are more likely to contain broadleaved woodland symbols and individual name on the first edition 6"maps. No conclusive evidence could be drawn from the toponymical research of townland placenames, although positive evidence may represent a useful complement to existing evidence of antiquity. As in Britain, it was found that PAW/AW sites were more likely to occur along parish boundaries.

Identification and application of AWVPs

The practical application of AWVPs is particularly important given the scarcity of archive information for individual woodlands. The list of 29 species presented in this study represents the first national list of AWVPs for the Republic of Ireland. It is important that these species are not used in isolation, but rather collectively as a group. A general rule of thumb, 'as the number

of AWVPs present at a site increases, so too does the probability that the woodland is ancient' (Rose 1999). Initial thresholds based on size have been set in the course of this study.

The failure to identify species that differentiate strongly between ancient and long-established woodland may be due to a number of factors, including the small sample size of the LEW (II) sites or inaccuracies in interpretation of the historical literature. Another theory proposed is that Ireland's flora lacks those true woodland specialists common to Britain and other European countries (e.g. *Paris quadrifolia*) that are strongly dependent on ancient woodland, and hence there may be only minor differences in the flora of these stand types. This is a theory which needs further testing. The use of bryophytes, lichens, fungi and invertebrates as potential indicators also needs investigating; such taxa take longer to survey but may show stronger relationships.

There are a number of rarer woodland species generally thought to have an affinity for older woodlands that did not make the indicator list. These were not recorded with sufficient frequency to be picked up by the analysis. They include: *Cephalanthera longifolia, Campanula trachelium*, *Hypericum hirsutum*, *Neottia nidus-avis, Lathraea squamaria, Melica uniflora, Prunus padus*, *Equisetum sylvaticum*. Further research is needed to investigate whether such species have a genuine relationship with ancient woodland sites in Ireland. Until then, the value of these species as ancillary indicators will have to be left to expert judgement.

The list of 29 AWVPs compiled by this study was compared with the recent list produced for Northern Ireland. Some of the Northern Ireland AWVPs appear to be of limited use in the Republic as they are either very common here (*Hedera helix, Lonicera periclymenum* and *Geranium robertianum*), pioneer species highly prevalent on developing degraded bog sites (*Betula pubescens*), or indicative of recent woodland (*Salix cinerea and Galium palustre*). Nevertheless, the Northern Ireland list contains indicators not supported by our present data that are commonly recognised in Britain, and may yet proved to be informative.

An avenue of research that may prove fruitful is the examination of 'ancient woodland planted sites' to assess the presence of AWVPs under conifers and mixed plantations and the potential for restoration of these sites.

Concluding remarks

The conservation importance of ancient woodland has long since been recognised in Britain, with several statute laws in place for their conservation (Goldberg *et al.* 2007). Progress of the same kind in Ireland has been hindered due to lack of research.

The provisional nature adopted by the inventory leaves it open to systematic revisions, should new information emerge. It is hoped that the work initiated here will be continued in the future. Previous ancient woodland research has found that ancient woodlands have quite disturbed histories in terms of exploitation (Bohan 1997; Little 1994), and their survival thus far only enhances the need to conserve them within the modern landscape.

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APPENDIX 1: GIS DATA LAYER ATTRIBUTES TABLE DESCRIPTION

Attribute Name	Description
Shape	Describes the geometry of the projection, i.e. polygon.
ALEW_ID	Refers to the identification of individual polygons.
Site_Name	The woodland name as referenced in the NSNW (Perrin *et al.* 2008).
Status	Refers to the woodland's historical status: ▪ PAW ▪ AW ▪ LEW (I) ▪ LEW (II)
Area	Area of polygon (m^2)
County	County in which the polygon is situated
Parish	Parish in which the polygon is situated
Townland	Townland in which the polygon is situated
Ownership	Refers to woodland ownership: ▪ PR (Private) ▪ NPWS (National Parks and Wildlife Service) ▪ CT (Coillte)
NSNW_No	Refers to the woodland's identification in the NSNW (Perrin *et al* 2008)
Wood_type	Refers to the woodland composition: ▪ SNB (Semi-natural Broadleaf) ▪ MW (Mixed woodland) ▪ CP (Conifer plantation) ▪ NNB (Non-native broadleaves) ▪ RC (Recent clearfell)
Survey	Refers to whether the polygon was surveyed: ▪ NSNW ▪ None
OSI_1st_ed/ OSI_3rd_ed	Refers to the woodland composition on 6″ OS maps: ▪ B (Broadleaved) ▪ M (Mixed) ▪ C (Conifer) ▪ BW (Brushwood)
Hyperlink	Used to hyperlink the text document detailing evidence of woodland status to the polygon

APPENDIX 2A: TOPONYMICAL RESEARCH INVESTIGATING TOWNLAND PLACENAMES FOR A SUBSET OF 41 POSSIBLE ANCIENT WOODLAND /ANCIENT WOODLAND SITES

NSNW No.	Woodland	County	Townland name	Gaelic	Suggested meaning
1624	Annaghwood	Galway	Annaghwood	*Coill an Eanaigh*	*Coill* meaning 'wood'; *An Eanaigh/Eanach* meaning 'a marsh or wet meadow'
1330	Ballyannan	Cork	Ballyannan	*Baile Uí Ainnín*	'O'Hannon's homestead'
1816	Ballyhamlet	Waterford	Ballyhamlet Ballyhander	*Baile an Chaimléasaigh* *Baile Shandair*	'Hamlet's town' 'Sander's town'
18	Ballykeefe	Kilkenny	Ballykeefe	*Cnoc Bhaile Uí Chaoimh*	'O' Keeffe's town'
1497	Bealkelly Woods	Clare	Bealkelly	*Béal na Coille*	'The mouth of the wood'
1344	Blarney Castle Woods	Cork	Blarney	*An Bhlarna*	'*Blar*' meaning 'a battle', 'a flowery banked stream' or 'the fine plain'
1777	Brackloon	Mayo	Brackloon	*Breac-chluain*	'Speckled lawn or meadow'
128	Brownswood	Kilkenny	Upperwood Demesne	English	The old name was Uppercourt but changed *c.* 1830 to Upperwood Demesne as it contained a gentleman's house surrounded by a wood
			Ballylarkin Ballyphilip	*Bhaile Uí Lorcáin* *Baile Philib*	'Lorcan's town' 'Philip's town'
1495	Camillan Wood	Kerry	Muckross	*Mucaros*	'Wood of the hogs' or 'Peninsula of the pigs'
1003	Castletown	Westmeath	Castletown	*Baile an Chaisleáin*	'Castle town'
1110	Cavestown	Westmeath	Cavestown Rosmead	English *Ros mid*	Caves town *'Ros'* meaning wood
574 / 575	Charleville South/North	Offaly	Ballinvogher	Baile an Bhothair	'Town of the road'
1400	Cullentra Wood	Sligo	Cullentra Killerry	*Cullentra* *Cill Oiridh*	'A place producing holly' '*Oiridh's* church'
1290	Derrycunihy	Kerry	Derrycunihy	*Doire Coinnithidh*	'Conihy's oak-wood'
1878	Drum Wood	Tipperary	Drum Wood Gortaculrush Brockagh	*Coill an Droma* *Gort a chulruis* *Brocach*	'Wood of the ridge' 'Field at the back of the wood' 'A place of badgers'
475	Drumcormick Wood	Roscommon	Drumcormick	*Druim Chormaic*	'Cormac's ridge'

NSNW No.	Woodland	County	Townland name	Gaelic	Suggested meaning
1449	Feddyglass Wood	Donegal	Feddyglass	*An Fhaiche Ghlas*	*Faiche* meaning 'lawn or green'; *Glas* meaning 'green'
1515	Garrannon Woods	Clare	Cratloe	*An Chreatalach*	*Creatalach* 'Sallow wood' or 'a place of sally-trees'
1597	Gortacarnaun	Galway	Gortacarnaun	*Gort an Charnáin*	*Gort* meaning 'field'; *Carn* meaning 'a heap or pile of stones'
			Lahardaun	*An Leathardán*	*Leath-ard* 'half height' - possibly meaning a very gentle slope
			Derreen	*Doirín*	'Little oak wood'
			Derrykeel	*Dhoirín an Charnáin*	*Dhoirín* meaning 'little oak wood'; *Carn* meaning 'a heap or pile of stones'
49	Grenan Wood	Kilkenny	Grenan	*An Grianán*	'A sunny place'
472	Hughstown Wood	Roscommon	Drumharlow	*Druim thúrlaich*	'Ridge of the dried lake'
1405	Kilbrattan Wood	Sligo	Kilbrattan	*Cill Bhreatain*	'Bretan's church'
769	Kilcommock Glebe	Longford	Kilcommock	*Cill Dachomóg*	'St. Dachomóg's church'
4	Killoughrum Forest	Wexford	Killoughrum	*Coill Eachroma*	C*oill* meaning 'wood'
1861	Knockanavar Wood	Tipperary	Knockanavar	*Cnocán na bhFear*	'Hill of the men' or 'a meeting place'
			Glengar	*An Ghleanna Ghearr*	'The short glen'
1097	Knockeyon Wood	Westmeath	Streamstown	*Baile an tSrutháin*	*Srutháin* meaning 'stream'
608	Parkhill	Laois	Abbeyleix was called Feranamanagh	*Feranamanagh*	'Monk's land'
1302	Prohus	Cork	Prohus	*Pruchas*	Unknown
			Inchinahoury	*Inse na hAmhraí*	Unknown
1291	Reenadinna Wood	Kerry	Muckross	*Mucaros*	'Wood of the hogs' or 'Peninsula of the pigs'
1600	Shannawoneen Wood	Galway	Shannawoneen	*Seanadh Mhóinín*	*Sean* meaning 'old'; M*óin* meaning 'bog'
			Shannagurraun	*Sheanadh Gharráin*	'Old shrubbery'
1237	St. Catherine's Park	Dublin	St. Catherine's Park	English	St. Catherine's Park
			Coldblow	Unknown	Unknown
			Lucan	*Leamhcan*	'Place of elms'
1308	St. Gobnet's	Cork	Gortnatubrid	*Ghort na Tiobratan*	'Of the *tiobraid* or spring well'
467	St. John's Wood	Roscommon	Rinnagan	*Rinn na gCeann*	'Point of the heads'

NSNW No.	Woodland	County	Townland name	Gaelic	Suggested meaning
1317	The Gearagh	Cork	Gearagh (East/ West)	*An Gaorthadh*	*Gaortha* meaning 'wooded valley'
			Raleigh South	*Ráth Luíoch Theas*	*Rath* meaning 'fort'
			Inchigeelagh	*Inse Geimhleach*	'Island of the prisoner'
			Dundareirke	*Dhún Dea-radhairc*	'Fort of two prospects'
69	Toberbride	Wexford	Toberbride	*Tobar Bríde*	'St Bridgit's well'
			Carrigbeg	*An Charraig Bheag*	*Carraig* meaning 'rock'; B*eg* meaning 'small'
1289	Tomies Wood	Kerry	Tomies Wood	*Na Tóimí*	'Tumaidhe (Toomy), tumuli or monumental mounds' - from two sepulchral heaps on top of the mountain
			Gortadirra	*Gort a doire*	'Field of the oak wood'
			Glena	*Gleann áth*	'Glen of the ford'
			Cullinagh	*Cuilleannach*	'A place abounding in holly'
749	Tomnafinnoge	Wicklow	Tomnafinnoge	*Tom na Feannóige*	'Mound of the hooded crow'
			Coolattin	*Cúil aitinn*	'Corner of furze'
			Ballykelly	*Baile Uí Ceallaigh*	'O'Kelly's town'
1273	Uragh	Kerry	Uragh	*An Iúrach / Iúbhrach*	'Yew-land'
			Inchinlough	*Inse an locha*	'Holm of the lough'
338	Vale of Clara	Wicklow	Cronybyrne	*Crón Uí Bhroin*	'O'Byrne's hollow'
			Clarabeg	*An Clárach Beag*	*Clarach* 'derived from the bridge that stood in this townland' or 'a great plain'
			Ballydowling	*Baile dubhlaing*	'O' Dowling's town'
			Glenwood	*Coill an Ghleanna*	'Wood of the glen'
			Ballylusk	*An Baile Loiscthe*	'Burnt town'
			Ballymanus	*Baile Mhánais*	'Manus's town'
			Ballyfree	*Bhaile an Fhraoich*	'Town of the *fraoch* or heath'
			Ballinakill	*Baile na Coille*	'Town of the wood'
			Copse	English	'A small wood or a coppice'
			Ballinderry	*Baile an Doire*	'Town of the oak wood'
			Rathdrum	*Rath droma*	'Fort on the ridge'
471	Warren Point	Roscommon	Rindoon	*Rinn dúin*	'Point of the doon or fort'

APPENDIX 2B: TOPONYMICAL RESEARCH INVESTIGATING THE TOWNLAND PLACENAMES FOR A SUBSET OF 26 LONG-ESTABLISHED WOODLAND (II) SITES

NSNW No.	Woodland	County	Townland name	Gaelic	Suggested meaning
685	Annagh	Meath	Annagh	*An Eanaigh / Eanach*	'A marsh or wet meadow'
1439	Ards Forest Park	Donegal	Ards	*An Ardaidh*	*Aird* meaning 'point, peninsula'
			Rinnasligo	*Rinn na Sligí*	*Rinn* meaning 'a point of land'
			Aghalattive	*Achadh Leath Taoibh / Acha laithig*	'Field of one side' or 'the west bank'
			Ballymore Lower	*An Baile Mór*	'Big town'
172	Ballingarry Wood	Wexford	Ballingarry	*Baile an Gharraí*	'Town of the garden'
154	Ballyboggan Lower	Wexford	Ballyboggan Lower	*Baile Uí Bhogáin*	*Baile* meaning 'town'; *Uí Bhogáin* possibly a family name
			Artramon	*Ard Chromáin*	'Croman's height'
1322	Ballyedmond	Cork	Ballyedmond	*Baile Éamainn*	'Edmond's town'
715	Balrath	Meath	Balrath	*Baile na Rátha*	'Town of the fort'
151	Bricketstown House	Wexford	Bricketstown	*Barr Muine*	*Barr* meaning 'the top, the highest point'; *Muine* meaning 'a shubbery'
1512	Caher Rice	Clare	Caher Rice	*An Chathair*	'A circular stone fort'
408	Caslan's Wood	Roscommon	Kiltrustan	*Cill Trosgain*	'Church of the staff'
540	Clonguish Wood	Longford	Castle Forbes	*Chaisleán Foirbis*	*Caisleán* meaning 'castle'
1479	Courtmacsherry	Cork	Courtmacsherry	*Cúirt Mhic Shéafraidh*	'Mansion of Mac Séafraidh'
3	Courtown Dunes/Glen	Wexford	Courtown	*Baile na Cúirte*	'Court town'
			Ballinatray	*Bhaile na Trá Íochtarach*	'Town of the beach'
1585	Cragbrien Wood	Clare	Cragbrien	*Craig Bhriain*	'O'Brien's Rock'
400	Derrycarne North	Leitrim	Derrycarne North	*Doire Carna*	'Oakwood of the carn or heap'
919	Fitzsimon's Wood	Dublin	Balally	*Baile Amhlaoibh*	'Amhlaoibh's Town'
699	Flemingstown East	Meath	Flemingstown East	*Baile an Phléamannaigh*	'Fleming's town'
1491	French Wood	Cork	Kilpatrick	*Cill Phádruig*	'St. Patrick's church'
1673	Glenribbeen Wood	Waterford	Glenribbeen	*Gleann Roibín*	*Gleann* meaning 'valley'
			Salterbridge	*Sáiltiobraid*	Unknown
			Glentaun East	*An Gleanntán Thoir*	*Gleanntán* meaning 'little glen'
			Lyrenacallee East	*Ladhar na Cailli*	*Ladhar* meaning 'fork'

NSNW No.	Woodland	County	Townland name	Gaelic	Suggested meaning
578	Hands Wood	Offaly	Ballydrohid	*Bhéal an Droichid*	'The town of the drohed or bridge'
1622	Horse Shoe Wood	Galway	Castlehacket	*Chaisleán an Haicéadaigh*	*Caisleán* meaning 'castle'
			Tobermina	*Thobar Maighne*	*Tobar* meaning 'well'
1210	Kilcleagh	Westmeath	Kilcleagh	Unknown	*Cill* meaning 'old church'
1492	Lackendarragh South	Cork	Lackendarragh South	*Leacan Darach*	'Glen-slope of the oakwood'
227	Lisdowney Wood	Kilkenny	Lisdowney	*Lios Dúnaígh*	'Downey's Fort'
1567	Maryfort	Clare	Maryfort	*Lios Mhiacháin*	'Miacháin's Fort'
1876	Moyaliff	Tipperary	Moyaliff	*Maigh Ailbhe*	'Ailbhe's or Alva's plain'
1967	Templemore Demesne	Tipperary	Templemore	*An Teampall Mór*	'Great church; a cathedral'

APPENDIX 2C: TOPONYMICAL RESEARCH INVESTIGATING THE TOWNLAND PLACENAMES FOR A SUBSET OF 60 RECENT WOODLAND SITES

NSNW No.	Woodland	County	Townland Name	Gaelic	Suggested Meaning
347	Annaghduff	Cavan	Annaghduff	*Eanach dubh*	'Black marsh'
			Elteen	*Ailtín*	'A small cliff or side of a glen'
853	Annamarron	Mayo	Annamarron	Eanach Uí Mhearáin	*Eanach* meaning 'a marsh/ wet meadow'
			Leeg	*An Líg / eithe*	*Eithe* meaning 'flagstone/ hollow'
265	Ballhuppahane	Laois	Ballhuppahane	*Baile Uí Shopachain*	'O'Soppahan's town'
206	Ballinrush	Carlow	Ballinrush	*Baile an Ruis*	'Town of the wood/point/ peninsula'
			Bealalaw	*Beal-a-lagha*	'Ford of the hill'
1812	Ballycong	Mayo	Ballycong	*Beúl atha cung*	'Mouth of the ford of the strait'
1489	Ballyduhig North	Cork	Ballyduhig North	*Baile Uí Dhuthaigh*	'O'Duffy's town'
			Killanully	*Cill an Eallaigh*	*Cill* meaning 'church/wood'
1574	Ballygarreen	Clare	Ballygarreen	*Baile Uí Ghirrín*	*Baile* meaning 'town'; *Uí Ghirrín* possibly a family name
			Lackareagh Beg	*An Leaca Riabhach Bheag*	'Small grey hill side'
			Ballycorney	*Baile Uí Choirne*	*Baile* meaning 'town'; *Uí Choirne* possibly a family name
			Knockadeereen	*Cnoc an Doirín*	'Hill of small oak woods'
1547	Ballyogan Beg	Clare	Ballyogan Beg	*Baile Uí Ógain*	'O'Hagan's town'
			Caherlough	*Cathair locha*	'Stone fort of the lough'
1691	Barkillew	Donegal	Barkillew	*Barr Choilleadh*	'Top wood' or 'top of the wood'
1211	Bolinarra Bog Wood	Westmeath	Bolinarra	Unknown	Unknown
1540	Bouleevin East	Clare	Bouleevin East	*Buaile aoibhinn*	'Delightful booley, or mountain dairy place'
1539	Boulleevin West	Clare	Boulleevin West	*Buaile aoibhinn*	'Delightful booley, or mountain dairy place'
268	Cappagh North	Laois	Cappagh North	*An Cheapach*	'A plot of land'
942	Carbury Wood	Kildare	Carbury	*Cairbre*	A tribal name
1735	Carrig East	Kerry	Letter	*Leitir*	'A hillside with tricklings of water'
1806	Clooneen	Mayo	Clooneen	*An Cluainín / Cluainín*	'Little meadow'
483	Cloonsillagh	Roscommon	Cloonsillagh	*Cluain Saileach*	'Lawn of the sallows'
			Knocknagawna	*Cnoc na ngamhna*	'Hill of the calves'

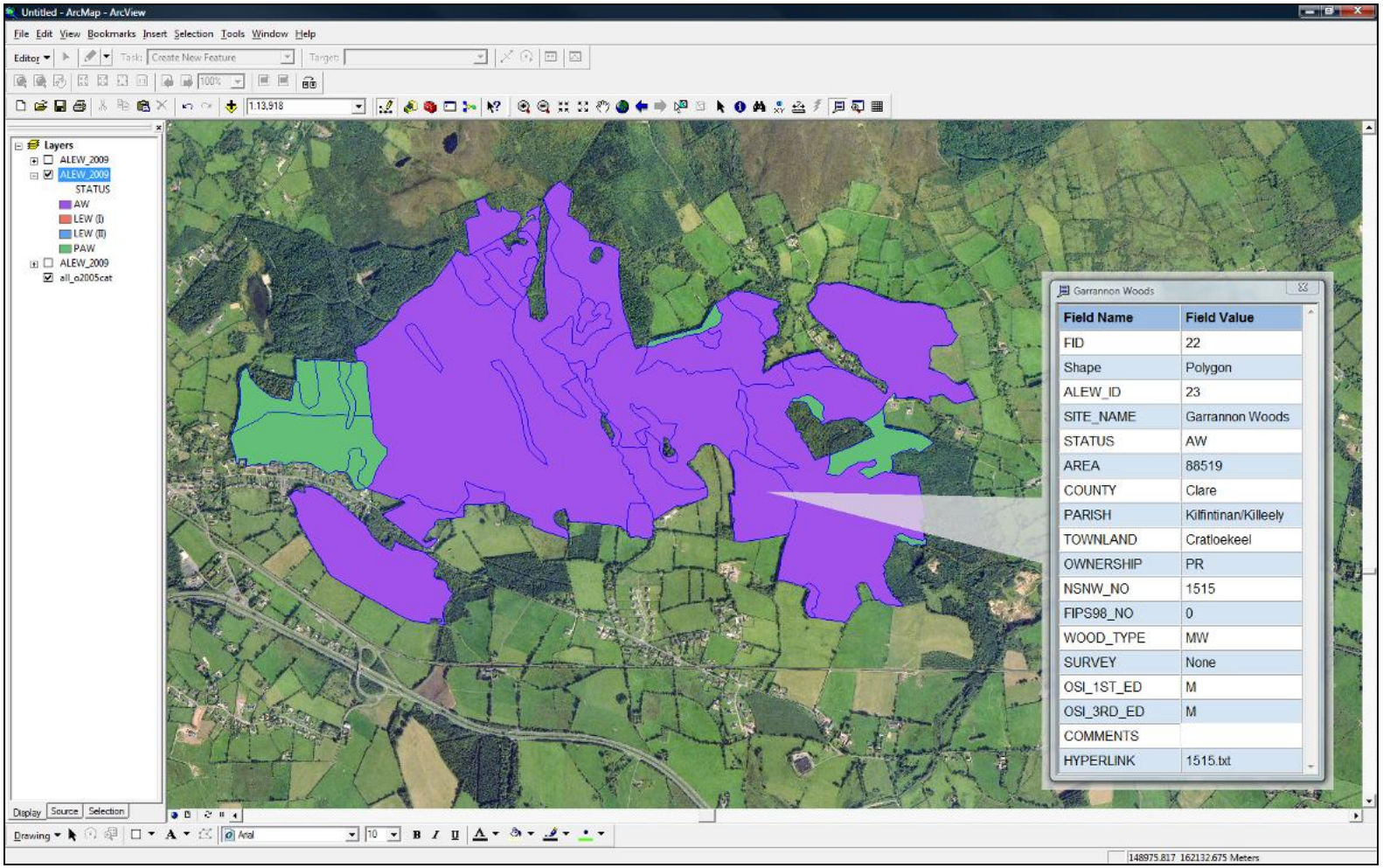
NSNW No.	Woodland	County	Townland Name	Gaelic	Suggested Meaning
256	Coolnamony	Laois	Coolnamony	*Cúl na móna*	'Back of the bog'
			Ballynalug	*Baile na log*	'Town of the hollows'
394	Corraleskin Wood	Leitrim	Corraleskin	Unknown	Unknown
1686	Crolly Bridge Woods	Donegal	Crolly	*Craithlidh*	'Shaking bog'
			Cronaguiggy	*Cró na gCúigeadh*	'Hollow of the Quiggs'
660	Cullies	Cavan	Cullies	*Coilidhe*	'Woodlands'
			Killaliss	*Cill a liosa*	'Church of the fort'
1379	Curragh East	Cork	Curragh East	*Currach*	'A shrubby moor'
1010	Derrylea Large	Kildare	Derrylea Large	*Doire liath* *Cluain Dubh Lusca*	'Grey oak wood' 'Lawn of the black cave'
407	Derryveen Wood	Mayo	Derryveen (Mayo)	*Doire Mheitheán*	*Doire* meaning 'oak'; *Mhianaigh* meaning 'of mines'
968	Drehid Wood	Kildare	Drehid	*Droichiod*	'A bridge'
1908	Drom	Kerry	Drom	*Drom*	'A ridge or long hill'
1383	Dromore	Cork	Dromore	*An Drom Mór*	'A big ridge or long hill'
1562	Drummaan South	Clare	Drummaan South	*Druim meádhon*	'Middle drum, ridge or long hill'
1465	Duvglasha	Cork	Gneeves	*Dhá Ghníomh* *Na Gníomha*	'Gneeves' refers to a measure of land
1057	Faltia	Roscommon	Faltia	*Fáilte*	'Welcome'
			Drumalagagh	*Druim ealagach,*	'Noble ridge'
1791	Farrantooreen	Kerry	Farrantooreen	*Fearann tóirín*	'Land of the little tory or outlaw'
			Ardmoneel	*Ard muiníl*	'Hill of the neck'
956	Fiddancoyle	Wicklow	Fiddancoyle	*Fiodán coill*	'Brook of the hazel'
1896	Friar's Lough Wood	Tipperary	Annagh	*An tEanach /Eanach*	'A marsh or wet meadow'
1471	Garranes	Cork	Garranes	*Garráin*	'Shrubberies'
1365	Glencam	Cork	Glencam	*Gleann cam*	'Crooked glen or valley'
			Ballyfireen	*Baile an fhirín*	'Town of the coarse grass'
770	Glenmore	Longford	Glenmore	*An Gleann Mór*	'A large glen or valley'
			Cartrons	*Na Cartúin*	An old measurement
1535	Gragan West	Clare	Gragan West	*An Ghrágáin Thiar*	'The little hamlet'

NSNW No.	Woodland	County	Townland Name	Gaelic	Suggested Meaning
1105	Higginstown Wood	Westmeath	Higginstown	English name	'Higgins' town'
1394	Inchideraille	Cork	Inchideraille	*Inse idir Dhá Aill*	'Island between two cliffs'
364	Keelrin	Leitrim	Keelrin	*Caolroinn*	'Narrow point'
			Mullaghboy	*An Mullach Buí*	'Yellow summit'
			Ardunsaghan	*Ard Uinseachan*	'The height of the ash trees'
1158	Killyconigan	Mayo	Killyconigan	*Coill Uí Chonnagáin*	'O'Cunningham's Wood'
1603	Killymongaun	Galway	Killymongaun	*Choill Uí Mhongáin*	'Uí Mhongáin's Wood'
448	Kilnaglare Lower Wood	Cavan	Drumsillagh	*Droim Saileach*	'Ridge of the willow trees'
			Kilnaglare Lower	*Coill na gclar*	'Wood of the boards or planks'
			Kilnaleck	*Coill na Leice*	'The wood of the flag- surfaced land'
1822	Knockaunbrandaun	Waterford	Knockaunbrandaun	*Cnocán Brandán*	'Little hill of Brandán'
903	Laragh	Wicklow	Laragh	*An Láithreach*	'Site' or 'ruins of a building'
1121	Lecarrow	Roscommon	Lecarrow	*Leath cheathramhadh*	'Half-quarter'
1892	Longorchard	Tipperary	Longorchard	*An tAbhallort Fada*	'Long orchard'
			Tullowmacjames	*Tulach Mhic Shéamais*	*Tulach* meaning 'a little hill'
			Derryville	*Doire Bhile*	'Oak town'
835	Mount Jessop	Longford	Mount Jessop	*Chnocán Iósaif*	'Joseph's Mountain'
967	Mullaghreelan Wood	Kildare	Mullaghreelan	*Mullach Raoireann*	'Raoirin's top or summit'
			Coolane	*An Collán / Culán*	'A small back'
1871	Newtown Wood	Mayo	Newtown	*An Baile Nua*	'New town'
			Kileen	*Cillín*	'A small church'
1596	Normangrove	Galway	Normangrove	*Áit Tí Dóite*	'The place of the burnt house'
			Cahererillan	*Chathair Oirealláin*	*Caher / cathair* meaning 'a circular stone fort'
1736	Oolagh East	Kerry	Oolagh East	*Abhlach Thoir*	'Abounding with apples'
1455	Oughtnadrin	Donegal	Oughtnadrin	Unknown	Unknown
1496	Poulaphuca Wood	Sligo	Longford Demesne	No direct translation for Longford Demesne	Poulaphuca meaning 'the Pooka's or demon's hole'
1666	Raford	Galway	Raford	*Ráth na Fulrachta*	*Ráth* meaning 'a circular fort'
			Clashaganny	*Chlais an Ghainimh*	*Clais* meaning 'a trench or furrow'

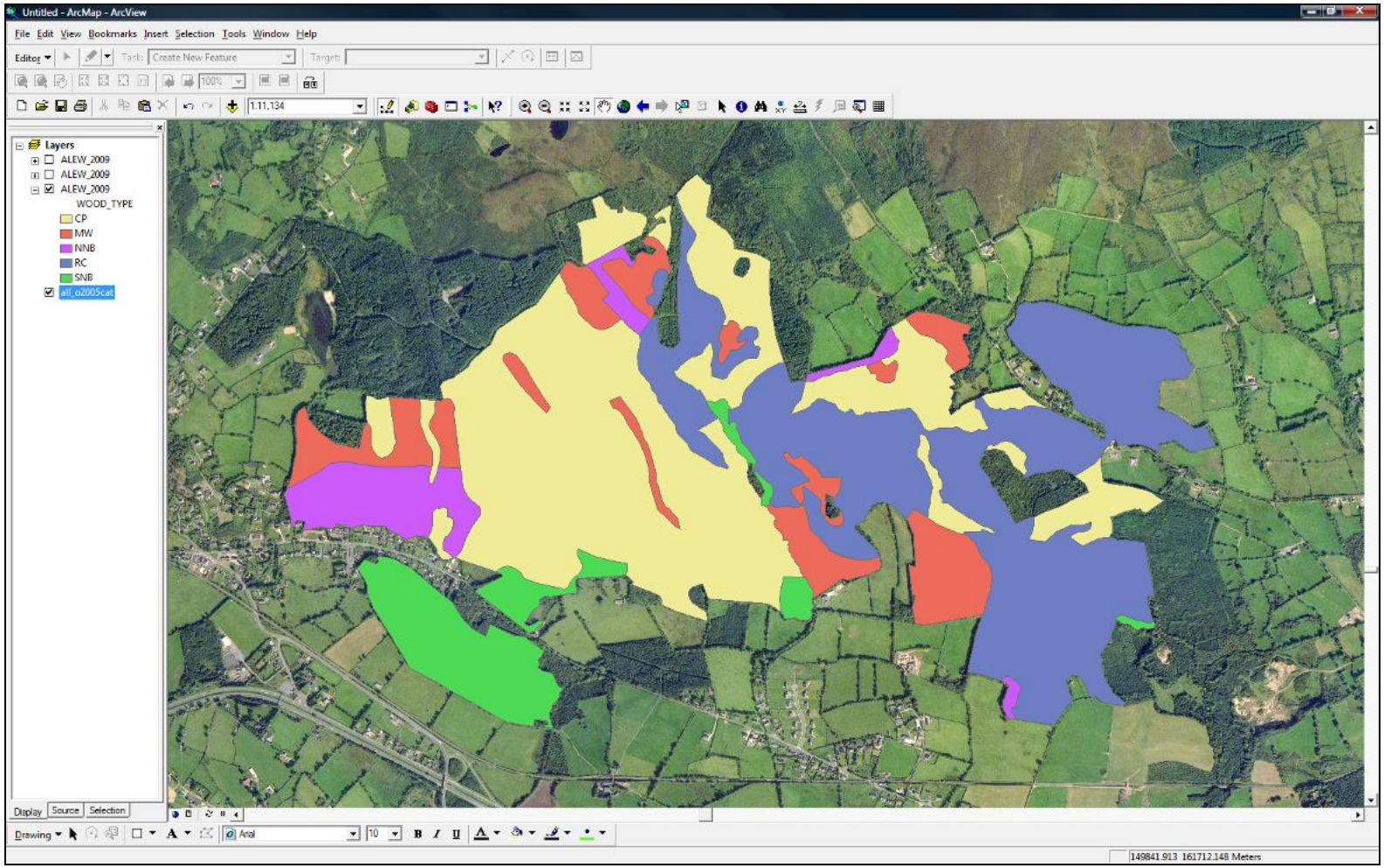
NSNW No.	Woodland	County	Townland Name	Gaelic	Suggested Meaning
1786	Rosturk	Mayo	Rosturk	*Ros tuirc*	'Hog's point'
1179	Stickillin	Louth	Stickillin	*Tigh Cillín*	'Cillín House'
1314	Toon Valley	Cork	Cooleen	*An Chúillín*	'Little corner'
			Cloonshear More	*Cluain Siabhra Mhór*	*Cluain* meaning 'a pasture'
			Aghacunna	*Áth an Chonnaidh*	'The field of the firewood'
1294	Toryhill	Limerick	Toryhill	*Cnoc Droma Asail*	'The hill of the ridge of Asal'; Asal probably the personal name rather than the animal (asal, 'donkey')

APPENDIX 3: EXAMPLE SCREENSHOTS FROM THE GIS DATABASE

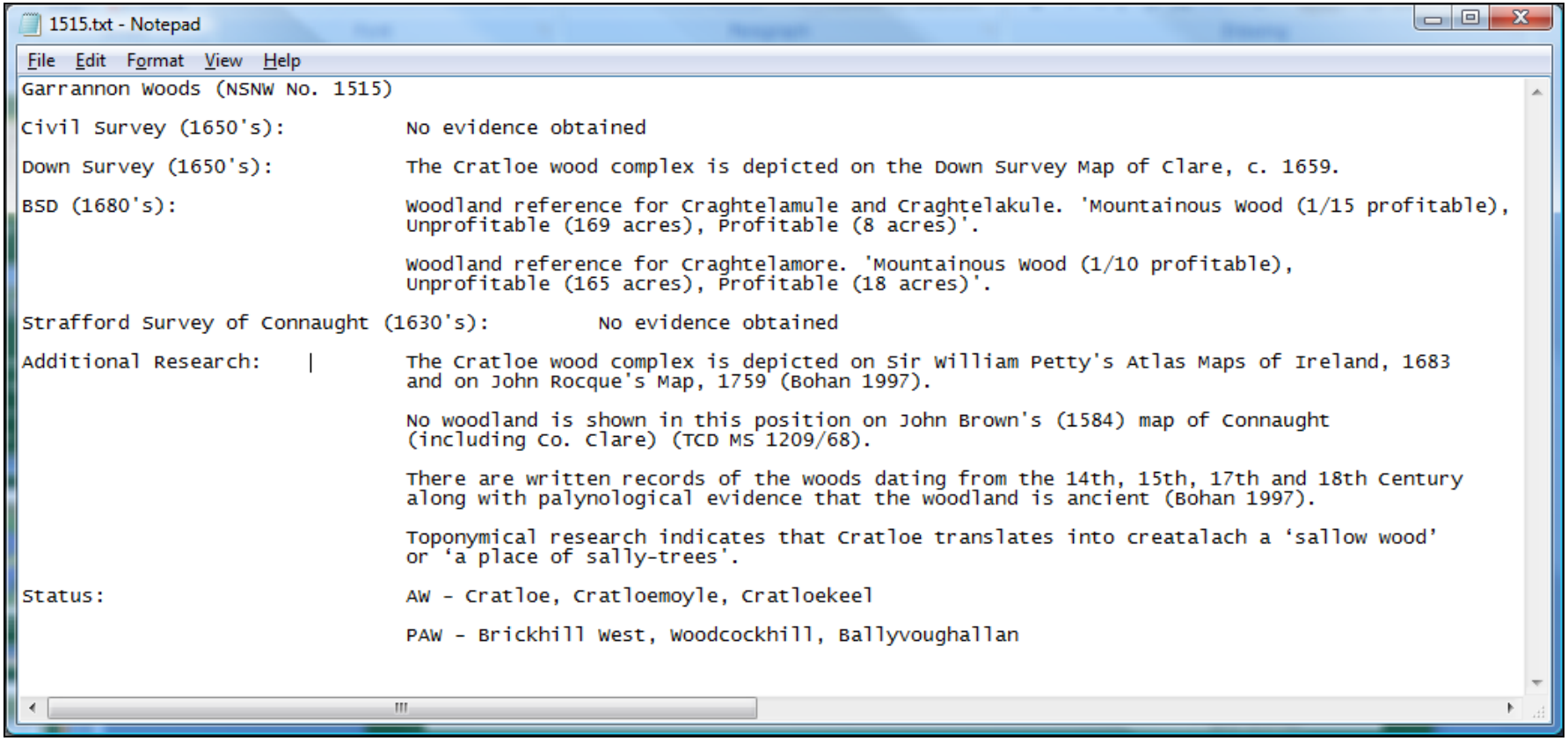
The GIS database is a project in ArcMap format. This screenshot shows the historical status map for Garranon Wood and the adjacent Cratloe Woods area in Co. Clare, displayed over the 2005 aerial photographs. Ancient Woodland areas are shown in purple and Possible Ancient Woodland areas in green. The pop-up window shows the data held in the attributes table for a particular polygon.



This screenshot of the same site shows the contemporary stand type map. The main area of semi-natural woodland is shown in green in the south-west of the site. Note that substantial areas defined as Ancient Woodland are now covered in conifer plantations (yellow) or mixed woodland (orange).



This final screenshot shows an example of the historical evidence that is held in the hyperlinked text files. There is one text file for each site and it is linked to every polygon in the site so that the viewer can quickly access the information on which the historical status has been decided. Should new evidence come to light, the status of the can then be easily re-evaluated.


1515.txt - Notepad
File Edit Format View Help
Garrannon Woods (NSNW No. 1515)
Civil Survey (1650's): No evidence obtained
Down Survey (1650's): The Cratloe wood complex is depicted on the Down Survey Map of Clare, c. 1659.
BSD (1680's): Woodland reference for Craghtelamule and Craghtelakule. 'Mountainous Wood (1/15 profitable), Unprofitable (169 acres), Profitable (8 acres)'.
Woodland reference for Craghtelamore. 'Mountainous Wood (1/10 profitable), Unprofitable (165 acres), Profitable (18 acres)'.
Strafford Survey of Connaught (1630's): No evidence obtained
Additional Research: The Cratloe wood complex is depicted on Sir William Petty's Atlas Maps of Ireland, 1683 and on John Rocque's Map, 1759 (Bohan 1997).
No woodland is shown in this position on John Brown's (1584) map of Connaught (including Co. Clare) (TCD MS 1209/68).
There are written records of the woods dating from the 14th, 15th, 17th and 18th Century along with palynological evidence that the woodland is ancient (Bohan 1997).
Toponymical research indicates that Cratloe translates into creatalach a 'sallow wood' or 'a place of sally-trees'.
Status: AW - Cratloe, Cratloemoyle, Cratloekeel
PAW - Brickhill West, Woodcockhill, Ballyvoughallan